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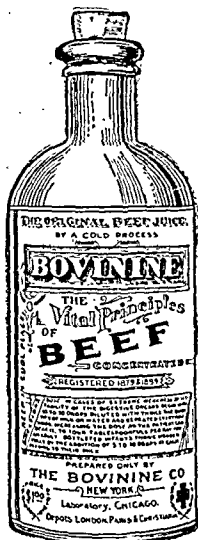
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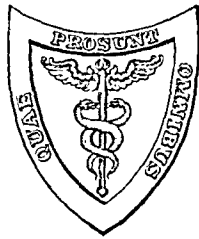
CHICAGO

THE  
AMERICAN JOURNAL  
OF THE  
MEDICAL SCIENCES

EDITED BY  
A. O. J. KELLY, M.D.

NEW SERIES

VOL. CXXXVI



PHILADELPHIA AND NEW YORK  
LEA & FEBIGER  
1908

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THE  
AMERICAN JOURNAL  
OF THE MEDICAL SCIENCES.

DECEMBER, 1908.

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ORIGINAL ARTICLES.

**TREATMENT OF TETANUS WITH SUBARACHNOID INJECTIONS  
OF MAGNESIUM SULPHATE.**

BY ROBERT T. MILLER, M.D.,

RESIDENT SURGEON AT THE JOHNS HOPKINS HOSPITAL, AND INSTRUCTOR IN SURGERY  
IN THE JOHNS HOPKINS UNIVERSITY, BALTIMORE.

IN December, 1905, Meltzer<sup>1</sup> published the results of a series of experiments he had made with the idea of proving magnesium to possess inhibiting power over the processes of the body. Briefly, the conclusions were to the effect that intravenous injections of small amounts inhibit respiration and cause paralysis of the entire body; that when applied directly to a nerve in a 25 per cent. solution it produces complete nerve block; that when injected subcutaneously it produces deep narcosis with complete muscular relaxation; and that a subarachnoid injection of a 25 per cent. solution produces immediate anesthesia and paralysis of the posterior extremities of monkeys. Acting upon the final conclusion, the practical value of subarachnoid injections of magnesium sulphate as a means of producing surgical anesthesia was soon put to test, and in May, 1906, Blake reported 12 cases which had been thus treated by Haubold, Meyer, and himself. In these cases they had followed Meltzer's suggestion and injected 1 c.c. of a 25 per cent. solution of magnesium sulphate to each twenty to twenty-five pounds of body weight, a dose found to be about one-third the lethal dose for monkeys. The result was found not altogether practical, as surgical anesthesia did not appear for three to four hours and it persisted longer than was

<sup>1</sup> Medical Record, 1905, lxviii, 965.

<sup>2</sup> Surgery, Gynecology, and Obstetrics, 1906, ii, 541; Annals of Surgery, 1906, xlv, 367.  
VOL. 136, NO. 6.—DECEMBER, 1908.



necessary. Its use as an anesthesia in surgery was then apparently given up with a passing recommendation in its favor in the treatment of aneurysm by compression, and in the performance of prostatectomy, and of amputation in diabetic subjects and in patients in shock. The paper concludes with a report of 2 cases of tetanus treated by the intraspinal injection of magnesium sulphate to control the convulsions: one successful and one unsuccessful case. Since then there have been reported 11 cases of tetanus treated by the injection of magnesium sulphate: 8 cases, 3 of which resulted in recovery, by subarachnoid injections; and 3 cases by subcutaneous infusions with magnesium sulphate, all of which were successful. Since the method seems to promise a great deal in the treatment of tetanus, the following case is reported:

*Resume of the Case: Boy, aged seven years. Diagnosis: tetanus. Incubation seven days. Admitted on the tenth day. Eleven lumbar punctures were made within thirteen days, approximately 2.5 c.c. of a 25 per cent. solution of magnesium sulphate being injected into the meninges at each puncture. Extensive paralysis followed each injection and involved usually all the muscles, except those of the head, neck, and diaphragm, and lasted approximately eighteen to twenty-nine hours. The injections were followed several times by respiratory collapse, lasting eleven to fourteen hours, and the pulse dropped, though not to a dangerous level. Antitoxin daily for fourteen days, in doses varying from 1500 to 7000 units; copious saline enemas and infusions; and sedatives for a short time, were also used in the treatment.*

E. K., a male, aged seven years (Surgical number 22,789), was admitted August 16, 1908; discharged September 19, 1908. Ten days before admission, while playing in the street, the patient was knocked down by a passing wagon and struck upon the cobble stones of the gutter, receiving a lacerated wound of the left hand. During the evening of the seventh day after the injury the patient had "locked jaws," bit his tongue, and had considerable difficulty in swallowing. On the following day the patient's jaws "locked" several times, and there was occasional twitching of the muscles of the hands and legs. Upon the ninth day while lying in bed the boy was noticed to have flexion of the fingers and wrists, general muscular twitching, and occasionally "stretched himself" (mild opisthotonos). Upon the morning of the tenth day he could open his teeth only approximately an inch, and he was brought to the clinic for treatment.

On admission the following note was made: Upon the dorsum of the left hand is a granulating wound, about 4 cm. in diameter, the base of which consists of greenish, necrotic tissue. The glands of the axilla are barely palpable. The child does not look ill, is interested in his surroundings, and quite rational. At irregular intervals, without apparent stimulus or when suddenly aroused, as by being touched or otherwise surprised, he has a general tonic

contraction of all the muscles of the body; during such an attack "risus sardonicus" appears, the right hand and arm are thrown upward and backward, the abdominal muscles are rigidly fixed, and the legs are held perfectly stiff in hyperextension. During these opisthotonic seizures the left elbow, wrist, and fingers (the wounded extremity) show marked spasmodic exaggeration of the flexion which is constantly present. The incisor teeth can be separated about 2.5 cm. During the period of observation, which lasted twenty minutes, the child had twelve convulsions, during two of which there was involuntary evacuation of the bowels. Routine examination of the chest was negative. The temperature was 100°, the pulse 80, and the respirations 20.

A diagnosis of acute tetanus of rather severe grade was made, and it was decided to attempt treatment by means of subarachnoid injections of magnesium sulphate, following the suggestion of Meltzer.

The estimated body-weight was sixty pounds. This estimate is probably high since the boy weighed but forty-one pounds on September 15.

*Injection 1.* August 16, 7.30 P.M. Under very light ether anesthesia a lumbar puncture was made, and a few cubic centimeters of clear fluid was withdrawn, apparently under no great tension; 2.5 c.c. of a 25 per cent. solution of magnesium sulphate was then gently injected, no special precautions being observed as to the speed of injection. The infected area on the left hand was then rapidly excised, the wound carbolized, and a dry dressing applied. An injection of 1500 units of antitetanic serum was made in the left thigh.

Within thirty to forty-five minutes all reflexes in the legs were abolished; however, at the end of two and one-half hours there was a convulsion, marked by trismus, hyperextension of the head, and involuntary movement of the bowels. This type of convulsion then recurred every fifteen to twenty minutes, either spontaneously or was precipitated by the slightest stimulus, as attempting to drink a sip of water. The legs were paralyzed and the reflexes absent, but in some of the convulsions the arms were moved. The child could not open the jaws any farther than before the lumbar puncture and was quite unable to take water. The temperature was 103° at midnight.

August 17. Convulsions of the above type continued in decreasing rate and severity, and by 4 A.M. (twenty and one-half hours) there were no muscular contractions below the arms, and the patient began to take liquids freely. At 10 A.M. (twenty-six and one-half hours) knee-jerks were present and motion was returning in the legs. By 2 P.M. his condition was about as on admission; he was unable to take liquids without precipitating a convulsion. The temperature reached 105.4° seven hours after the first injection.

*Injection 2.* At 4.30 P.M. lumbar puncture was done under chloroform anesthesia, and 25 c.c. of cloudy fluid withdrawn; injection

of 2.5 c.c. of 25 per cent. solution of magnesium sulphate immediately followed. This injection was followed by a profound reaction. There was, as usual, loss of knee-jerks and paralysis of the legs and abdominal muscles, but the most striking effect was upon the respiration, the rate of which dropped within three and one-half hours to eight per minute, and within four and one-half hours to six per minute, becoming shallow and gasping and varying greatly in amplitude. The pulse remained full and regular and there was no cyanosis. The patient was in profound coma, and not until 11.30 P.M. (seven hours) did any convulsive muscular action appear; at this time the facial muscles began to twitch irregularly and there was slight trismus. Antitoxin, 1500 units, was given in the thigh.

August 18. At 1.15 A.M. (nine hours) respirations were 6 to the minute, and each ended in trismus which was becoming very severe. This condition persisted until 5 A.M. (twelve hours) when respirations began to increase in rate and amplitude and by 6.30 A.M. had returned practically to normal. From their first appearance the twitchings of the facial muscles increased slowly, until at 5 A.M. (twelve hours) the convulsive seizures were occurring about once per minute. The tongue was bleeding from the continued traumatism of trismus. By 9 A.M. (sixteen hours) the boy began to take fluids freely and continued to do so all day. Drinking or any disturbance caused facial spasm and trismus, but not until 3 P.M. (twenty-three hours) did the knee-jerks return. At 5 P.M. (twenty-five hours) there was opisthotonos, which appeared twelve times within the next sixteen hours. During this severe respiratory disturbance there was a very free secretion of mucus which seemed to embarrass respiration somewhat; atropine,  $\frac{1}{156}$  grain, was administered hypodermically. During the day 3000 units of antitoxin were administered.

August 19. The effect of the second injection was so alarming that some little hesitation was felt about proceeding; the boy had been in profound coma and for twelve hours had been watched constantly, since the need for artificial respiration seemed imminent. The result of this hesitation, however, is shown, for during the first part of the day, that is, from midnight until 9.30 A.M. he was in practically continuous opisthotonos, convulsions occurring every two to three minutes. He had taken practically no liquids since midnight previously.

*Injection 3.* Chloroform anesthesia. At 9.30 A.M., 2 c.c. of a 16.6 per cent. solution of magnesium sulphate, a considerably smaller dose than formerly, was given. The cerebrospinal fluid obtained seemed normal, and but 5 c.c. was removed. The head was elevated somewhat to prevent the injected fluid from reaching the respiratory centre. During the first four hours there was a gradual loss of knee reflexes; they returned slightly by 5 P.M. (seven and one-half hours), at which time facial spasm again appeared for the first

time since the last injection. Five hours after the injection the boy began to take liquids freely. This injection was likewise attended with bronchorrhœa. At 8 P.M. (ten and one-half hours) general convulsions involving the whole body again appeared. During the day the patient was given 3000 units of antitoxin.

August 20. The convulsions increased in rate and severity and by 5 A.M. (nineteen hours) typical opisthotonic seizures were occurring every ten to fifteen minutes. In spite of this fact the boy took liquids well.

*Injection 4.* 11 A.M. Under chloroform anesthesia, 3 c.c. of slightly cloudy fluid was removed, and 2.5 c.c. of 25 per cent. magnesium sulphate solution was injected. At this time there was continuous opisthotonos; within twenty minutes spasm of the abdominal and leg muscles began to disappear; within one and one-half hours the knee-jerks had disappeared; and within three and one-half hours the jaw was well relaxed, but there was facial spasm and trismus with each expiration. For thirteen hours the boy was unconscious, and during this period there was another respiratory collapse; within two and one-half hours the respiratory rate began to fall, and within three and one-half hours respirations were weak, shallow, and only five to the minute, at which rate they remained for three and one-half hours; they reached normal rate and amplitude within eleven hours of the time of injection. During this period there was again considerable secretion of mucus, for which atropine was again administered. During the day 4500 units of antitoxin were administered.

August 21. The boy regained consciousness about midnight (thirteen hours), but in spite of the muscular relaxation he seemed unable to take liquids well because of difficulty in swallowing. He was, however, quiet and seemed comfortable. By 9 A.M. (twenty-two hours) the knee-jerks had returned; opisthotonos soon appeared, and by 4 P.M. (twenty-nine hours) was more marked than ever before.

*Injection 5.* At 4 P.M. 19.5 c.c. of spinal fluid was obtained, and 2.5 c.c. of a 25 per cent. magnesium sulphate solution was injected. Within one hour the knee-jerks had disappeared and the abdominal muscles were soft. Within two hours respirations became diminished in rate and volume, and within four hours were weak, shallow, irregular in rate and amplitude, and about five to the minute; they remained of this character for about an hour, when improvement appeared, and within fourteen hours from the time of injection they were again normal.

The boy was taking little or nothing and he was accordingly fed by the stomach tube, which procedure disturbed him not at all. 3000 units of antitoxin were given during the day.

August 22. The boy was unconscious until 6 A.M. (fourteen hours), at which time he evidently appreciated his surroundings. He remained rather stupid, however, and had to be fed with the stomach

tube. There was a gradual return of muscular tonicity by 5 P.M. (twenty-five hours), however, and when the patient was turned upon his side for lumbar puncture he was in opisthotonos and perfectly rigid.

*Injection 6.* At 7.30 P.M. 3 c.c. of turbid fluid was withdrawn, and 2.5 c.c. of a 25 per cent. magnesium sulphate solution was injected. A moderate respiratory disturbance followed; the rate began to drop within two hours and within four and one-half hours had reached nine to the minute, at which level it remained for three hours; it reached normal rate and amplitude within twelve hours. There was again great secretion of mucus. The child was again in coma. During the day he was fed by the stomach tube, and 9000 units of antitoxin were given.

August 23. During the day the patient was quiet and had no convulsions. He, however, was evidently growing weaker and seemed more stupid; he was taking nothing by the mouth. There was still profuse secretion of mucus. At 5 P.M. (twenty-one and one-half hours) the abdominal muscles began to stiffen; the legs were flaccid, and the knee-jerks were absent. The reflexes of the forearm were present. Trismus became marked. During the day 3000 units of antitoxin were administered.

August 24. A convulsion occurred at 4 A.M. (thirty-two hours since the last injection); by 8 A.M. (thirty-six hours) tonic spasm of the body was almost continuous, and opisthotonos was extreme, the body resting on the head and heels.

*Injection 7.* 9.30 A.M. Lumbar puncture; no anesthesia; 2.25 c.c. of 25 per cent. solution of magnesium sulphate was injected. This injection was followed by little respiratory disturbance. The usual paralysis followed; the patient was apparently weaker and becoming exhausted, and accurate observations upon the effect of the magnesium were impossible. He, however, remained quiet, and except for an occasional groan was apparently in comfort. During the day 7500 units of antitoxin were given. The patient was still fed with the stomach tube.

August 25. A mild convulsion was observed at 3 A.M. (eighteen hours); there was a steady increase in the muscular spasm, and by 6 A.M. (twenty-one hours) the patient was rigid and in extreme opisthotonos, which condition persisted until noon.

*Injection 8.* 12 M. Lumbar puncture; no anesthesia; 2.75 c.c. of 25 per cent. solution of magnesium sulphate was injected. This was followed by the usual paralysis which persisted longer than usual, and was attended by but slight respiratory disturbance. The mucous secretion was more marked than usual, appearing within three hours. Muscular relaxation was present throughout, except in the neck, which remained stiff. The patient was quiet and apparently comfortable, although one could not be quite certain that he was clear mentally. During the day he was fed by the

stomach tube and 1500 c.c. of antitoxin were injected into the thigh.

August 26. The boy remained very quiet. By 1 P.M. (twenty-five hours) the legs became more rigid; at 2 P.M. (twenty-six hours) general, mild convulsions appeared and increased rapidly in severity until at 8 P.M. (thirty-two hours) they were occurring almost every minute, being provoked by the mildest stimulation and throwing the boy into extreme opisthotonos.

*Injection 9.* 10.30 P.M. Lumbar puncture; no anesthesia; 3 c.c. of 25 per cent. solution of magnesium sulphate was injected. During the day 1500 c.c. of antitoxin were injected into the thigh and the patient was still fed with the stomach tube.

August 27. Following the lumbar puncture the boy rested quietly. At 5 A.M. (six hours) he was moving his hands and opened his eyes when spoken to, but did not reply. During the day he seemed much brighter and, except for occasional facial spasms, was quite free; during the afternoon he took liquids freely. During the day 3000 units of antitoxin were given. The patient was fed by means of the stomach tube.

August 28. At midnight (twenty-five and one-half hours) a moderately severe general convulsion appeared; general convulsions then increased rapidly in severity and frequency until by 4 A.M. (thirty hours) they were extreme, throwing the boy into exaggerated opisthotonos.

*Injection 10.* 5 A.M. Lumbar puncture; no anesthesia; 3 c.c. of 25 per cent. solution of magnesium sulphate was injected. This injection was followed by profound collapse; within five hours the temperature dropped to 95.2°, the pulse to 104, the respirations to 16, and the patient was comatose. The dose of magnesium was somewhat larger than usual, because of the severity of symptoms; this may account for the collapse, but it is to be noted that the patient was very weak, had been on artificial feeding for six days, and during the preceding twenty four-hours had had a diarrhoea. Under appropriate treatment the boy soon improved and by evening was in good condition and comfortable. He was given 3000 units of antitoxin during the day and was fed by stomach tube.

August 29. At 3 A.M. (twenty-two hours) there was a mild general convulsion, but the night was a quiet one and he was greatly improved. In the morning he responded to questions by nodding and could move his hands and feet. By 10 A.M. (twenty-nine hours) reflexes were beginning to return, but all muscles seemed rather relaxed except those of the neck, which was hyperextended. His mental condition improved during the day, but muscular rigidity slowly appeared and by 10 P.M. (forty-one hours) was rather severe, trismus being frequent.

*Injection 11.* 10 P.M. Lumbar puncture; no anesthesia; 2.25 c.c. of 25 per cent. solution of magnesium sulphate was injected. This

was followed by the usual paralysis. During the day 3000 units of antitoxin were injected. The patient was fed by the stomach tube.

August 30. The boy had a good night and during the afternoon began to take liquids freely. At 8 P.M. the following note was made: "Answers questions intelligently with yes or no. Opens teeth 4 cm. Good motion of legs and arms. Abdomen soft. Taking nourishment well. Voiding urine. No muscular rigidity. Knee jerks not exaggerated. Change in general condition within twenty-four hours is remarkable."

August 31. During the night there were several mild convulsions, but his condition in the morning was good.

During the next three days the boy was troubled with severe muscular spasm of the left hand and forearm; either spontaneously or upon slight stimulation the left forearm, wrist, and hand would go into violent flexion, which he was powerless to prevent and which caused him great pain. This condition gradually disappeared and his convalescence was without event except for an otitis media, which cleared up promptly, and several small abscesses, one of which came upon the occiput and was apparently due to the trauma sustained during opisthotonos.

September 19. The patient was discharged.

September 28. Examination is negative. There is no increase of reflexes, and no muscular rigidity. The boy is apparently in the best of health.

This case may safely be classed as a severe case of acute tetanus. Attempts to grow the specific organism from the necrotic tissue excised from the wound were not successful, but of the clinical identity of the disease there can be no doubt. It was not a case of the fulminant type of the disease, but from the severity of the symptoms and the rapidity of development after their appearance, it may without question be classed as a severe type, in which the mortality is great. Intraspinal injections of magnesium sulphate formed the principal part of the successful treatment. It is true that antitoxin was used over a prolonged period, but the administration of antitoxin after the appearance of symptoms has never been proved to be of any benefit, and its use in this instance was regarded merely as a possible aid, in which, however, no faith was had.

Of the value of the treatment by magnesium sulphate suggested by Meltzer, no one who witnessed this case has any doubt. A patient in violent spasm and continuous opisthotonos was repeatedly reduced to complete and lasting relaxation in the course of a few minutes by an intraspinal injection of magnesium sulphate; a result was thus achieved surely, promptly, and safely, which can be but weakly approximated by the usual sedatives, and even then after hours instead of minutes. Death in tetanus is said to be due, in one-half the cases, to asthenia produced by the excessive muscular

action and inability to take food, and in most of the remaining cases to asphyxia during a convulsion; inasmuch as we have in magnesium a means of blocking all motor impulses to the muscles, thereby preventing their action, it seems reasonable to suppose that the system, thus spared the enormous expenditure of energy incident to convulsions, may be able in some way to convert that energy into a means of protecting itself and may possibly even be aided in the production of a specific antitoxin. This, of course, is as yet pure speculation and has been repeatedly referred to; until we understand more of the formation of antitoxin by the body and of the action of the tetanus toxin it will remain speculative. It may be possible, as Blake suggests, that during this preliminary stage, before the body has formed its own antitoxin, the use of artificial antitoxin is of value; this likewise is problematical. Be the theory what it may, there seems no doubt that the use of magnesium is beneficial in tetanus; by its use it was possible to reduce this patient from a condition of violent muscular spasm to one of complete relaxation lasting from ten and one-half to twenty-nine hours, usually about twenty-four hours.

The chief danger in the use of intraspinal injections of magnesium lies in its direct depressing influence upon the respiratory centre; this effect was produced repeatedly. The first injection produced no apparent effect upon respiration, nor did the third injection, which consisted of a smaller dose and of less concentration than usual (2 c.c. of 16.6 per cent. solution), and was thus possibly too small to affect the respiratory centre. After each of the other injections, however, there was a more or less marked drop in respiratory rate, which was accompanied by a decrease and irregularity of amplitude; this change in respiration was of eleven to fourteen hours' duration and in some instances alarming, notably after the second and fourth injections, when the rate dropped to seven and five per minute respectively, necessitating constant watching and preparation for immediate artificial respiration. In spite of this respiratory collapse, however, the circulation remained in good condition; there was no cyanosis and the pulse remained regular and steady throughout. Each respiratory collapse was accompanied by a fall in pulse rate, the curve of which followed that of the respiration rather accurately. One must regret that no blood-pressure observations were made during those periods, inasmuch as it seems highly likely that there may have been a fall and that the pulse if followed accurately with regard to blood pressure would have shown a distinct drop. The actual drop in pulse rate is of interest, inasmuch as Meltzer states that "heart and pulse remain normal" in anesthesia achieved by intraspinal injection of magnesium. There was also an apparent decrease in effect upon respiratory rate with repeated administration of the same or increasing doses. In no instance did the patient's condition demand a second lumbar puncture to wash the salt out



of the canal, as recommended by Meltzer. As a precaution the head was elevated during and after the third and subsequent injections, in order to prevent the injected fluid from reaching directly the respiratory centre. The injection was frequently followed by a profuse secretion of mucus, at times severe enough to embarrass respiration, but apparently easily controlled with atropine. This condition is referred to by Logan<sup>3</sup> and others.

After each injection there followed promptly a paralysis of the legs, abdominal walls, sometimes the arms, while the neck and masseters usually escaped, and the muscles of the face practically always remained unaffected. This paralysis appeared within thirty to sixty minutes and varied in duration from eighteen to twenty-nine hours. Several instances have been reported in which perfect, although transient, use of muscles (legs) followed an injection; in only two instances did that occur in this case.

Owing to the uncertain mental condition of the child, due to the illness, any observations as to sensation and subjective state are scarcely trustworthy; it seems certain, however, that he was comatose for thirteen hours after the fourth injection and for fourteen hours after the fifth.

No constant effect of the injection of the magnesium upon temperature was shown. After the first, third, sixth, and eleventh injections there was a decided rise; the ninth injection had no effect, and a fall in temperature followed the remaining five injections. The only variation in temperature of any serious consequence occurred during the collapse after the tenth injection.

Retention of urine was the rule and it was necessary to catheterize the patient for nine days, August 20 to 29, that is, from the time of the fourth to the eleventh injection. Previous to that time he had been voiding urine frequently and in small amounts; he probably had a paradoxical incontinence. The bowels moved involuntarily throughout the illness; in how far this was due to the magnesium injections is, of course, a question. No purgative effect was noted from the magnesium absorbed.

In this case magnesium did not relax the masseters and pharyngeal muscles sufficiently to allow the patient to take nourishment throughout. From August 21 to August 30, that is, from the fifth until the last injection had been given, it was necessary to feed the boy by means of the stomach tube, which he bore very well. In addition, normal salt solution infusions were given repeatedly as well as salt enemas, which were retained. After the last injection small amounts of chloral and bromide were used for a few days.

Regarding the technique of lumbar puncture it may be said: our first punctures were made between the second and third lumbar vertebræ; this site soon became excoriated owing to too vigorous

<sup>3</sup> Jour. Amer. Med. Assoc., 1906, xlvii, 1502.

cleansing and the subsequent punctures were made between the first and second lumbar vertebrae, the skin being cleansed simply with soap and water, alcohol, and ether. A varying amount of cerebrospinal fluid was withdrawn. An interesting and very important point, to which no reference has been found, is the change in the cerebrospinal fluid following the punctures: the second puncture was made twenty-one hours after the first and 25 c.c. of a very turbid, grayish fluid was withdrawn. The appearance of the fluid suggested meningitis, but no organisms were found in stained specimens and cultures remained sterile; it was subsequently learned that this finding is not infrequent after the injection of serum in meningitis and is due to the presence of white blood corpuscles in the cerebrospinal fluid. At subsequent punctures turbid fluid was usually found, but never in such large amount as at the second puncture.

The following is a brief abstract of the cases reported to date:

CASE I.—(Blake.) Male, aged fifteen years, seven days after a crushing injury of the left hand began to show stiffness of the jaw and neck. Upon admission to the hospital there was well-marked tetanus. Under nitrous oxide anesthesia, 40 c.c. of tetanus antitoxin was introduced into the cervical meninges, and 20 c.c. into the median cephalic vein. The following day 35 c.c. of antitoxin was injected into the lumbar meninges. This treatment was without avail. On the following day, that is, the third, 4.5 c.c. of a 25 per cent. solution of magnesium sulphate was injected into the lumbar meninges. Stiffness of the entire body disappeared in six hours and the patient took nourishment well. On the following day the convulsions returned and in thirty-three hours the effects of the injection had entirely disappeared. A second lumbar puncture was done, 8 c.c. of a 12.5 per cent. solution of magnesium sulphate was injected. A similar reaction followed; the spasm gradually returned, and the injection was repeated in twenty-nine hours. Five days later the last lumbar puncture was done, 12.5 per cent. solution being used. After this injection his muscular spasm never returned and his convalescence was without event.

CASE II.—(Blake.) Seven days after the reception of a wound of the leg the first symptoms of tetanus appeared. Extreme convulsions rapidly supervened. The patient upon admission to the hospital was immediately given 1.5 c.c. of a 25 per cent. solution of magnesium sulphate into the lumbar meninges. Within two hours he was somewhat relaxed. Slight convulsions, however, continued to occur and he died sixteen hours after the injection, which apparently was in no way to blame for the child's exitus. Autopsy revealed tetanus bacteremia. The case was apparently hopeless from the start.

CASE III.—(Logan.) Male, aged eleven years. An incubation period of nine days following a gunshot wound of the hand. Typical tetanus upon admission. Bromides and chloral were

given. On the following day general convulsions appeared together with opisthotonos. 4 c.c. of a 25 per cent. solution of magnesium sulphate was injected by lumbar puncture; 50 c.c. of antitoxin was injected into the sciatic nerves, brachial plexus, and the tissues around the wound. Complete relaxation occurred in forty-five minutes. Profuse bronchorrhœa occurred in four hours and forty minutes. The tonic spasms returned thirteen hours after the injection. A second injection was followed by complete muscular relaxation. Severe convulsions appeared two hours and fifteen minutes after the second injection and were due to the administration of an enema. Respiratory failure followed three hours after the injection, and the patient died seventeen hours after the injection from cardiac collapse, the pulse ceasing to beat before respiration stopped.

CASE IV.—(Logan.) Female, aged twenty-four years. Uncertain incubation following vaccination of the arm. Fulminant attack of severe tetanus for which two injections of 4 c.c. of a 25 per cent. solution of magnesium sulphate in the lumbar meninges were given, each without avail. Death followed shortly after the second injection. Apparently a hopeless case.

CASE V.—(Franke<sup>4</sup>.) Male, aged thirty-five years. Incubation period of twelve days. Typical though mild tetanus. Three injections, first of 1 c.c., then of 2 c.c., of 25 per cent. solution of magnesium sulphate into the lumbar meninges. Marked cessation of muscular spasm followed each injection. Voluntary motion returned and the patient took nourishment well. Complete recovery. In this instance muscular relaxation apparently lasted about thirty hours. The case was not severe.

CASE VI.—(Robinson<sup>5</sup>.) Male, aged eleven years. Uncertain incubation period. Typical tetanus of moderate grade. Immediate injection of 3 c.c. of 25 per cent. solution of magnesium sulphate. In two and one-half hours complete muscular relaxation, absence of knee-jerks. No return of opisthotonos. Complete return of rigidity within eighteen hours. Second injection 3.5 c.c. of 25 per cent. solution of magnesium sulphate. Complete muscular relaxation in one and three-quarter hours which lasted certainly more than ten hours. Third injection two days after the second, 4 c.c. of 25 per cent. solution injected into the lumbar meninges. In one hour complete absence of spasm; in two hours complete relaxation; in fifteen hours slight return of rigidity. From this time on slight rigidity, with decreasing tetanic symptoms. Patient discharged well in the course of two weeks.

CASE VII.—(Greeley<sup>6</sup>.) Male, aged two years. Uncertain incubation period. Apparently typical tetanus of moderate grade. Two subcutaneous infusions, each containing magnesium sulphate,

<sup>4</sup> Zentralbl. f. inn. Med., 1907, xxviii, 345.

<sup>5</sup> Jour. Amer. Med. Assoc., 1907, xlix, 493.

<sup>6</sup> Ibid., 940.

2 drams, were given on successive days. Complete subsidence of symptoms. Typical but apparently not a severe case.

CASE VIII.—(Greeley.) Male, aged forty-five years. Chronic tetanus. Incubation period of four weeks. Slight stiffness of neck and inability to open the mouth. Symptoms subsided completely after injection of 3 drams of magnesium sulphate solution subcutaneously. Apparently a very mild grade of chronic tetanus.

CASE IX.—(Lyon.<sup>7</sup>) Male, aged seven years. Incubation period of eight days. Moderately severe tetanic symptoms by the eleventh day. On the twelfth day 2 drams of magnesium sulphate was given under the skin in the abdomen. Muscles were markedly relaxed. On the following day injections were repeated for return of symptoms, and again on the second, fifth, and seventh days after the first injection. Apparently a complete cure.

CASE X.—(Henry.<sup>8</sup>) Male, aged nine years. Incubation period of three days. Severe typical tetanus upon admission. 3 c.c. of 25 per cent. solution of magnesium sulphate injected three times for muscular spasm, leading to complete relaxation in two hours. During the period between injections patient was comfortable, taking nourishment fairly well. Catheterization necessary. Result, cure.

CASE XI.—(Henry.) Male, aged nineteen years. Seven days' incubation. Severe tetanus with moderate opisthotonos on admission. Lumbar puncture. Injection of 6 c.c. of 25 per cent. solution of magnesium sulphate. Two and one-half hours patient in a deep sleep, difficult to arouse. On the following day rigidity was most pronounced. On the third day was as marked as upon admission, and upon the fourth day patient died, apparently in collapse.

CASE XII.—(Henry.) Male, aged nine years. Six days' incubation period. Severe tetanus upon admission. Injection of 2.5 c.c. of 25 per cent. solution of magnesium sulphate. Complete relaxation in two hours. Reappearance of rigidity in nine hours. Lumbar puncture again performed and injection of 2 c.c. of magnesium sulphate, without any result. Condition grew worse and patient died.

CASE XIII.—(Henry.) Male, aged forty-five years. Three weeks' incubation period. Slight trismus upon admission. The following day rigidity increased. Lumbar puncture was performed, and 6 c.c. of 25 per cent. solution of magnesium sulphate injected. Upon injection patient immediately complained of burning sensation up to the base of the skull and along the main nerve trunk. This severe pain lasted for fifteen minutes. Complete relaxation occurred in one hour; on the second day a similar injection was made with similar results. Following the second injection, however, the patient fell into a deep sleep, was completely relaxed, respiration

<sup>7</sup> Jour. Amer. Med. Assoc., 1908, 1, 1688.

<sup>8</sup> International Clinics, 1907, iv, 1.

became shallow, and temperature and pulse rising. The following day he remained dull and sleepy, came to an end unconsciously and died without any rigidity being present. The reporter says: "It is very much a question whether the magnesium sulphate did not contribute to the patient's death."

There are thus 14 cases on record treated with magnesium sulphate. Of 11 cases treated by subarachnoid injections 5 have recovered, a mortality of 55 per cent. This result is encouraging, inasmuch as almost all the cases in this series were of that type of tetanus which usually proves fatal; 3 cases were treated by infusion, none of them of severe type, and there were 3 recoveries.

In conclusion, it may be affirmed that by the use of magnesium sulphate it is possible to achieve complete muscular relaxation in almost all cases of tetanus; from the report of results there seems to be a distinct benefit to the patient in this condition, inasmuch as it prevents the rapid exhaustion due to convulsions and in most instances has made it possible for the patient to take nourishment. It may likewise be affirmed that, while as yet there is comparatively little clinical evidence upon which to base general statements, yet it seems possible to avoid the dangerous effects of an overdose of magnesium salts, and it is likely that when the technique has been worked out thoroughly the treatment will offer a possibility of saving a great many patients with tetanus who at the present time are given up as hopeless at first sight.

I desire to express my gratitude to Professor William S. Halsted for the privilege of reporting the case. For the fulness and accuracy of the clinical notes, I am indebted to Drs. J. H. Chesnutt and R. D. McClure.

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## TRACTION IN THE TREATMENT OF HIP DISEASE.

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If surgical clinics in different cities are visited one finds that there is great diversity in the manner of treating hip disease. If, however, the subject is examined more closely it will be found that the accepted principles of treatment do not vary greatly. Surgeons treating a chronic affection, with changing indications, may vary in their opinion as to which symptoms demand most attention, and in this way they may differ.

It is now generally admitted that radical operative interference in hip disease is not to be undertaken until other measures have failed; in this paper for the sake of brevity the subjects of excision, amputation, and erosion will not be considered. It is also universally believed that in combating hip disease (a tuberculous affection) as much fresh air and activity as is possible is of the greatest importance; no space will be devoted here to an exposition of the advantages of these essentials of treatment, nor of the necessity of proper nutrition.

The methods of treatment at present in general use may be grouped as follows: (1) The method with little reliance upon mechanical aids; (2) the method utilizing the Thomas splint; (3) that attempting a plaster-of-Paris fixation as the chief feature of conservative treatment; and (4) a method attributing much value to traction.

1. TREATMENT WITH LITTLE MECHANICAL AID. In neglected cases the course of the development of tuberculous coxitis is but little influenced by treatment. In the initial stage, and when little pain is present, the child may limp and avoid instinctively, or is prevented from making, violent motion of the joint; later, as the disease progresses and the tissues are more extensively involved, there may be much sensitiveness and pain, night cries from exaggerated muscular irritability, and distortion from tonic muscular spasm; finally, disorganization of the joint occurs, destruction of the head, and obliteration of the upper border of the acetabulum take place with the flexed and adducted position of the limb, firmly held "splinted" against the pelvis by stiffened muscles and contracted ligaments (Figs. 1 to 4). The acute pain, if present, ceases as the destructive osteitis becomes walled off or is supplanted by a constructive osteitis. The patient, confined, by pain or the sensitiveness of the limb on motion, to the bed or lounge, becomes able to move about, and needing crutches or a crutch on account of the distortion of the limb is able to go about with comparative freedom, and, eventually, in a large number of cases, is cured with a distorted limb. In a certain number of cases in which the process is considerable, the tuberculous detritus acts as an irritant; an abscess is developed, which may be absorbed and remain an encapsulated caseous mass, or may enlarge, force its way through the fascia and skin and evacuate itself, leaving a sinus which heals under normal conditions. Secondary infection of the tissues is, however, not infrequent, extending to the bone which becomes involved in infective osteomyelitis, which in a certain number of cases leads to extensive necrosis, chronic sepsis, amyloid disease of kidneys, and death or chronic invalidism. In a majority of cases immunity becomes established in time, and recovery takes place, leaving the patient in a more or less crippled condition.

As this process is one which lasts for years and is often characterized by alternate periods of improvement and relapse, it is not unnatural that those in charge of the nursing of the patient, seeing im-

provement follow any suggested remedy from the seton to faith cure, attribute such improvement to the applied remedy, while in reality recovery from the disease is not exceptional. The true measure of the success of a method of treatment is the amount of resulting deformity, rather than the fact of recovery from pain. Usually the child is kept in bed during the acute stage, with some arrangement for the correction of deformity. Crutches are given later to limit the weight bearing use of the limb as soon as locomotion is



FIG. 1.—Radiogram of a case of hip disease not treated by traction, showing deformity and pathological dislocation. (Bradford.)

possible. Later still, the patients are practically left to the curative process of Nature, protected from jars only by the occasional or intermittent use of canes or crutches.

Diseased bone may, in a short time, regain enough strength to bear slight strain without injury and without pain. The patient walks and is encouraged to walk by the fact of freedom from pain, but until the bone is restored to its normal strength, the danger of injury to tissue from violence, incident to ordinary activity, cannot

be avoided. Under this condition after slight bruises either a relapse occurs, or enough irritation is kept up to develop deformity. It is to these facts, that is, the occasional relapse and the gradual development of the deformity, which gives rise to the popular belief in the practical incurability of the affection. In the minds of many surgeons also without an extensive study of the course of the affection, through a long period of years and under many differing conditions and methods of treatment, an opinion becomes established that if the general health is maintained, mechanical treatment is of little importance.

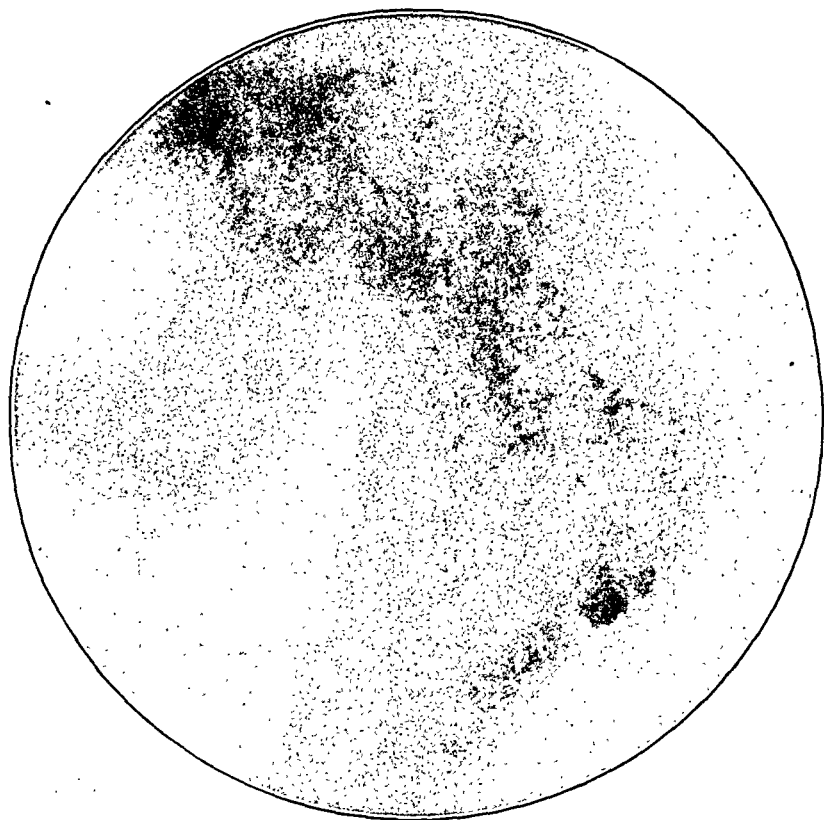


FIG. 2.—Radiogram of a case of hip disease (with abscess) twenty years after the cessation of treatment by thorough traction and protection. A strong, useful limb without deformity, with slight motion; photograph in Fig. 19. (Bradford.)

In fact, a large proportion of cases of imperfectly treated hip disease will recover eventually without treatment, but with deformity of greater or less severity; this ensues, in many cases, after years of suffering and the frequent occurrence of abscess and resulting sinuses, and not infrequently sepsis and septic osteomyelitis.

2. THE THOMAS SPLINT. The irksomeness of bed confinement, the "wire britches" (that is, the gouttière de Bonnet) employed by



the French surgeons, and the manifest need of some treatment for the disease, led to the introduction by Mr. Thomas, of Liverpool, of his excellent apparatus. It is somewhat singular that so admirable a contrivance as this should have found so little general acceptance in the surgical world. It is easily made, an efficient aid, inexpensive and requires a skill for adjustment no greater than can be acquired by anyone familiar with the use of appliances needed in the treatment of fractures. The advantages of the method have been often demonstrated, notably by Mr. Thomas himself, and at present by Mr. Jones, of Liverpool, and Dr. Ridlon, of Chicago; and, lately, in an excellent manner, by Dr. Bennie, of Australia; but they have not been as generally adopted by surgeons as the merits of the apparatus deserve.



FIG. 3.—Section of a hip-joint with hip disease, showing deformity and pathological dislocation. (Bradford.)

The chief reason why the Thomas splint has not met with general adoption is, in all probability, the simple one that surgeons avoid mechanical aids when possible. In the larger surgical clinics where patients are treated in great numbers, the operative demands are so great and the interest in operative methods is such, that little time and thought are given to the use of mechanisms. A mechanical appliance usually is left to juniors, or assistants, and is often imperfectly applied with unsatisfactory results. It is much easier to order the application of plaster-of-Paris, with which the student or assistant is usually familiar. In addition there are certain im-

perfections in the Thomas splint itself as an ideal appliance which prevents its enthusiastic acceptance by specialists.

It furnishes imperfect fixation, it does not prevent increased interarticular pressure, and it does not prevent the development of pathological dislocation. For larger patients it is an awkward appliance. It necessitates the use of crutches, and does not allow

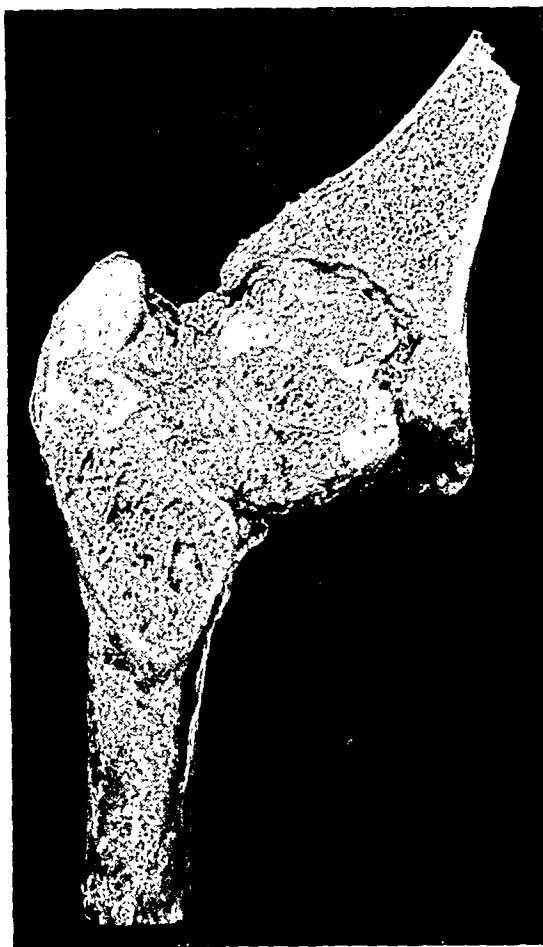


FIG. 4.—Section of a hip-joint after hip disease of a severe suppurating type. Death occurred from tuberculous meningitis three years after the patient had discarded traction treatment for hip disease: the limb was useful, and there was no deformity and no pathological dislocation at the hip. Traction had been applied efficiently for one year. (Bradford.)

the patient to sit with comfort. On the other hand, although some skill is demanded in its adjustment, this is not sufficient to prevent its ready use. It enables the patient to move or to be handled without discomfort except during the acutest stage, it diminishes or prevents flexion deformity, and it checks but does not prevent adduction. In double hip disease it is an admirable appliance. Mr. Thomas

himself made no extravagant claims for the appliance, stating that while hip disease could be cured probably as quickly without this splint, the care of the case was easier, and the patient suffered less, and there was less deformity than when it was not employed. The splint is more agreeable to patients than an efficient plaster bandage to the trunk and thigh.

3. PLASTER-OF-PARIS BANDAGES. A surgeon in charge of a large number of patients placed in an institution is obliged to devote his attention to the development of a method of treatment adapted to his nursing facilities. A well-applied plaster-of-Paris spica bandage, reaching from above the mammillary line to below the knee, placing the patient in a portable frame with facilities for moving the patient about freely, and an abundant supply of fresh air, combine to afford a method of treatment which is satisfactory during the acute stages of the affection, without a demand on a large nursing force. This is the treatment so successfully conducted at Berck sur Mer; but a short spica bandage, combined with crutches in common use in many clinics, as an ambulatory method of treatment of hip disease, cannot be recommended as a thorough method of treatment.

4. TRACTION APPLIANCES. The employment of traction, that is, a pull, in the treatment of hip disease is one which is naturally suggested by the distorted position of the limb and the muscular spasm which evidently crowds the head of the femur into the acetabulum, increasing the destructive osteitis in the direction of the pressure, aggravating the disease, and increasing the deformity. As extravagant claims, however, were at first made of the benefits to be derived from traction as the chief principle of treatment in hip disease; as expensive, elaborate appliances requiring special skill in adjustment, and much care in nursing have often been recommended in the treatment of hip disease, it is natural that the method of treatment be regarded with doubt. The active surgeon not without reason looks upon an expensive, complicated apparatus, needing special training for adjustment, as unsuited for general use. That, however, the principles of the judicious employment of traction in hip disease are sound, and that they have in practice been applied with great benefit has been abundantly shown. The method merits the careful attention of surgeons.

Although it is possible to classify the methods of treatment of hip disease in groups, in actual practice the treatment of hip disease varies greatly—from that which confines the patient for years to a couch, to attempts at “motion without friction” (as it is termed) of hips treated by splints, or to locomotion at will with the expectation that the application of a plaster-of-Paris spica will help the cure of the disease. In this maze of inconsistency, treatment should follow the clue furnished by pathological evidence which clearly indicates the advantage of the prevention of bone crowding.

If traction is applied to a normal adult hip, it will be found at

first to have no appreciable effect in distraction, that is, in drawing the head of the femur from the acetabulum, even if a considerable force or pull is applied—thirty pounds. The first effect is probably to stimulate the action of the powerful hip muscles so that the hip is held even more firmly than before. This has led some observers to infer that traction has no influence in drawing the head of the femur away from the acetabulum. If, however, a pull is applied to a diseased hip when the cotyloid ligament and the zona orbicularis are disorganized by the inflammatory process involving the capsule, it will be seen that even with a moderate pull of six pounds a marked distraction can be effected. This is demonstrated if a diseased joint is incised and the finger is inserted into the joint. It can also be shown by careful measurements of the length of a limb with a diseased hip, when a patient has been subjected to a traction pull for a few days. If any further proof is needed it will be furnished by a skiagram of a tuberculous hip-joint subjected to efficient traction. It will be seen that it is possible to draw a diseased femoral head away from the acetabulum, meeting a manifest indication to promote the healing of a joint surface affected with osteitis, and especially a hip-joint. If, in a given case even when there is little pathological relaxation of the capsule, a traction force is applied for a sufficient length of time, it will be found that a distracting effect will, in time, be accomplished. There is no doubt, therefore, that the surgeon has at his command a means of promoting healing by separating the diseased surfaces in hip disease under certain conditions.

If it is desired to immobilize the hip-joint absolutely, the difficulty of the attempt will at once be seen. Every motion of the trunk or of either extremity is transmitted to the pelvis which forms a part of the hip-joint. The futility of an attempt at exact fixation by securing the affected limb with a heavy plaster bandage, leaving the other limb free, is apparent; neither is absolute hip fixation secured by encasing the trunk with a plaster-of-Paris bandage, as it is impossible to prevent by means of a bandage the movements of the lumbar spine, or by compression upon the ribs to hold the upper portion of the trunk from motion. Furthermore, firm pressure upon the ribs prevents respiration and is impracticable. For absolute fixation it is necessary to hold firmly the whole trunk and both lower extremities. This is shown if an attempt is made to take a skiagraphic picture of a hip-joint when the patient moves the trunk.

The problem may be likened to that which would be presented if it were desired to prevent a snake from wriggling. This could be more readily done if the head of the snake were held and firm traction put upon the tail, than if the snake were placed within a glass tube. A rope made taut resists side pressure better than a slack one. Traction experiments upon a cadaver, using an efficient traction splint, made by my colleague, Dr. A. Thorndike, as well as

upon patients, demonstrated what has already been shown by Judson and others, that traction properly applied furnishes the best method of fixation to hip-joints. If the theoretical advantages of traction are accepted it should follow that practically when traction is properly applied better results should be secured than when this method is not employed (Figs. 5 to 9).

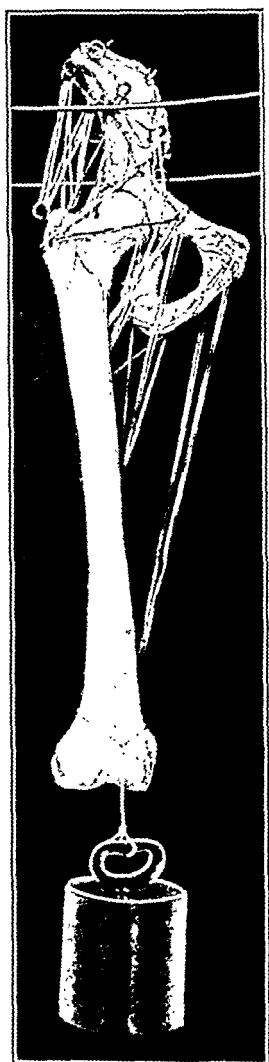


FIG. 5.—Illustrating the force of muscular contractions of the muscles controlling the hip. The weight is twelve pounds. Elastic bands are placed at the origin and insertion of each muscle, one band only for each muscle. (Bradford.)

In this connection the statistics of hip disease at the Boston Children's Hospital are of interest. Treatment, during the last thirty years, has included some form of effective traction during the acute and subacute stages of the disease, although all other known

methods of treatment have been thoroughly tried. The cases are treated largely in the out-patient department (with traction or protection splints), except in the more acute stage or when operative interference is needed. Those suffering from abscesses or in the



FIG. 6.—Radiogram of hip disease without traction. (Bradford.)



FIG. 7.—Radiogram of hip disease with ten pounds' traction. (Bradford.)

more severe or acute stages are referred to the in-service. A country convalescent home, seashore homes, district nursing, and a school for crippled children aid in the continued care of the patients.

The number of cases recorded and treated for hip diseases in the out-patient service, between the years 1883 and 1907, was 1809. Of these 983 were subsequently admitted as in-patients at the hos-

pital, representing the severer cases, and among these 502 were suppurative cases, that is, 30 per cent.

The operations other than incision of abscesses performed were as follows: between the years 1879 and 1907, 1154 cases: Amputations (at the hip-joint), 2; 1 surviving twenty years later and 1 death. Excision (including the cases subsequently amputated), 64; 9 deaths, 9 per cent. In addition to these a number of arthrotomies, curetting of the femoral head and neck, channelling of the neck, and 4 cases of dislocation of the head by incision in acetabular disease—with apparent relief. The general mortality of cases in the in-service is as follows, from the years 1895 to 1908: 606 cases of hip disease, 25 deaths, that is, 4 per cent. The causes of death were:



FIG. 8.—Amputation at the hip-joint at the age of eight years for hip disease, with extensive caries of the ilium. The amputation removed irritating pressure. The periosteum around the femur was saved in the flap. (Bradford.)

12 tuberculous meningitis; 1 empyema; 1 double hip disease; 1 hip disease and caries of the spine; 1 scarlet fever; 1 diphtheria; 1 after excision; 1 after abdominal incision for acetabular drainage; 6 from uncomplicated hip disease; total, 25. The mortality for uncomplicated hip disease was 1 per cent.

Of the 1809 recorded cases in the out-patient department, 144 are noted as having sinuses. This may be taken to indicate that in a majority of the cases with abscesses incised in the in-service there was little recurrence.

In order to determine more accurately the ultimate results, after a number of years, obtained by treatment, upward of four hundred postal cards were addressed to patients whose records showed that the affection was of sufficient severity to demand attendance at the

out-patient service for a year or more, but no patient was communicated with who was admitted after the year 1899 (the inquiry being made in January, 1908).

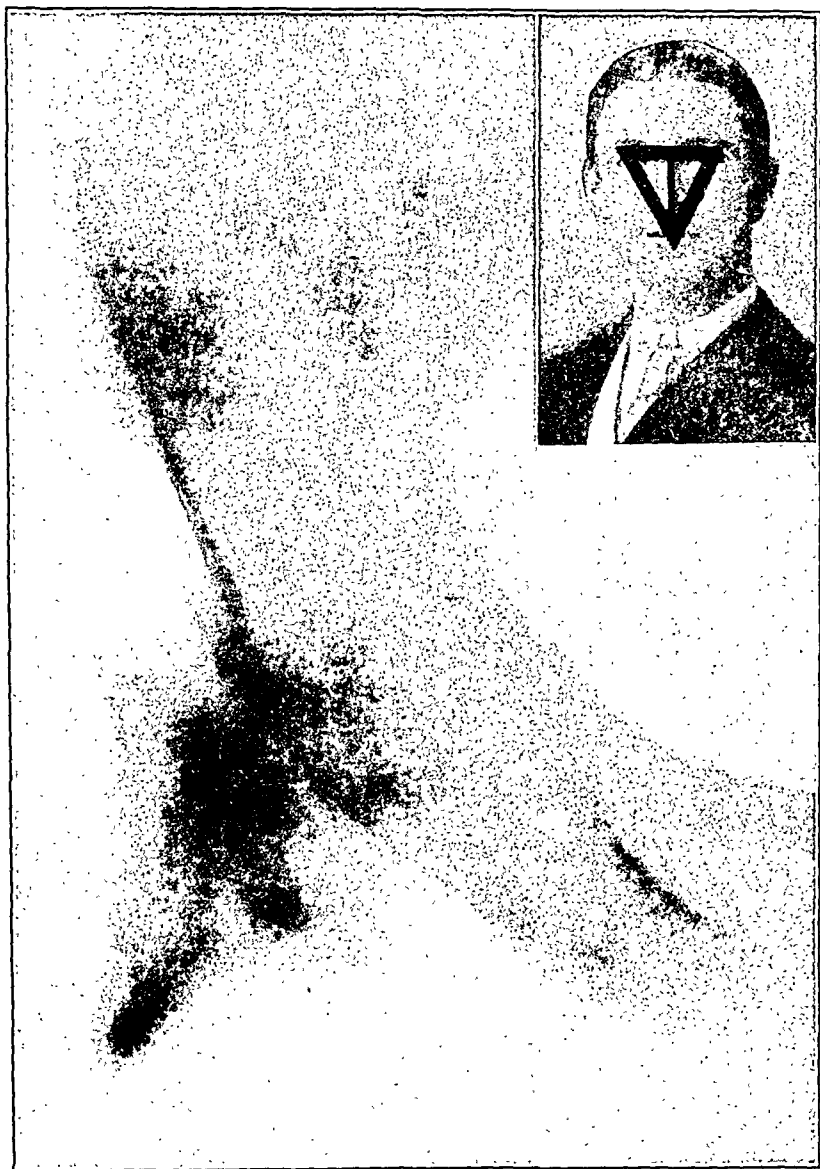


FIG. 9.—Radiogram and portrait of the same patient shown in Fig. 8 twenty years later. From the periosteum bone growth developed, enabling the patient to wear an artificial leg and aiding him to lead an active business life. (Bradford.)

One hundred and sixty-seven replies were received, stating that of these 9 had died from the complications following hip disease; 2 of these had recovered from the affection of the hip, but had died, 1 from an operation for appendicitis and the other from some dis-



ease not stated, unconnected with the disease of the hip, and after he had recovered from this; that is, a mortality of 6 per cent. approximately. 32 reported their ability to walk without limp; 46 with slight limp; 52 with limp the amount not stated; 5 with a bad limp; 1 required an apparatus and crutch; 1 required a crutch. All reported their ability to work or attend school; none were bed ridden or disabled, with the exception of those requiring crutches. On further investigation more full replies were received from 98 of the 167 patients.

The amount of shortening was reported to be, none in 12; one inch and under in 26; between one and two inches in 28; between two and three inches in 11; between three and four inches in 10; over four inches in 8; in 3 the shortening was stated as slight, but the amount was not given; that is, in nearly 70 per cent. the shortening was under two inches; 35 had had abscesses; 5 had discharging sinuses; that is, 37 per cent. suppurating cases.

A personal examination was made of as many of these latter cases as could be seen, with the following results: 26 were found to be non-suppurating cases (that is, had never had an abscess); 25 were cases previously suffering from abscesses and sinuses; in none were any unhealed sinuses. Of the 26 non-suppurative cases: In 11 the motion was perfect (that is, 90 degrees or over); in 7 there was slight motion (under 10 degrees); in 8 there was no motion. There was deformity of flexion in 11 as follows: 1 of 10 degrees; 2 of 15 degrees; 1 of 25 degrees; 1 of 30 degrees; 1 of 40 degrees; 3 of 45 degrees; 1 of 50 degrees; 1 had abduction of 40 degrees after Gant's operation. There was deformity of adduction in 8 as follows: 1 of 10 degrees; 2 of 20 degrees; 1 of 25 degrees; 2 of 30 degrees; 1 of 40 degrees; 1 of 45 degrees. There was no pathological dislocation in 19, the trochanter being below the Nélaton line. In 3 the trochanter was one-half inch above the line; in 1 was one inch; in 1 was one and one-half inches; in 1 was two inches; in 1 was three inches. In the 25 suppurative cases (that is, with previous abscess), there was stiffness at the hip-joint in 11; slight motion in 7; good motion in 2 (20 degrees to 30 degrees); perfect motion (90 degrees or over) in 5. There was a permanent flexion deformity in 15 as follows: 4 with 10 degrees; 2 with 15 degrees; 2 with 20 degrees; 1 with 25 degrees; 1 with 40 degrees; 2 with 45 degrees; 1 with 55 degrees; 2 with 60 degrees. In 2 there was abduction: 1 of 10 degrees, and 1 of 20 degrees. In 12 there was adduction as follows: 5 of 10 degrees; 1 of 15 degrees; 1 of 30 degrees; 1 of 40 degrees; 2 of 45 degrees; 2 of 50 degrees. In 12 there was no pathological dislocation, the trochanter not being above Nélaton's line. In 1 the trochanter was one-half inch above the line; in 3 was one inch; in 3 was one and one-half inches; in 2 was two inches; in 1 was two and one-half inches; in 1 was three and one-half inches. In 1, a case of excision, there was no deformity, a strong useful leg, but three inches

shortening. No correction of deformity was made in these cases with the exception of 1, on whom a Gant operation had been performed. None of the patients needed crutches or apparatus. All walked about freely, any desirable distance. The results can be summarized as follows: It was found that the ultimate mortality was 6 per cent. For the cases under treatment in the hospital the mortality was 4 per cent. The percentage of abscesses for the cases under treatment was 30 to 37 per cent. The ultimate results showed useful limbs in 98 per cent. Shortening of less than two inches in 70 per cent. of the non-suppurative cases; perfect motion, 90 degrees or over, in 40 per cent. of the non-suppurative cases; absence of flexion deformity in 60 per cent., and absence of pathological dislocation in 70 per cent.

In the suppurative cases there was perfect motion in 20 per cent. In free flexion there was good motion (20 per cent.) in 10 per cent. of the cases. There was absence of deformity in 40 per cent. There was absence of pathological dislocation in 40 per cent.

To estimate the value of these results a comparison should be made with the results recorded in other institutions and under other treatments. It should be borne in mind that the statistics of the Boston Children's Hospital are not taken from selected cases or cases placed under favorable circumstances. Many of them were neglected cases with existing deformity and pathological changes when treatment was first undertaken at the Children's Hospital. Pains were taken to verify the diagnoses in the cases by the recorded testimony of competent observers through a sufficiently long period, and doubtful cases were rejected; but otherwise the cases represent those presenting themselves at a charitable hospital from the poorer class in a large American city. In the worst cases they received the benefit of a stay in a convalescent home for a time, but the greater part of the treatment was under home care.

The recent report of the results from treatment, by means of a plaster-of-Paris spica bandage with crutches, of a number of cases at a seaside home, may be used in comparison.<sup>1</sup>

These cases were at a seaside home and the observations were upon cases two years after the beginning of treatment, ages four to fifteen years. The treatment consisted of a plaster-of-Paris bandage applied from the mammillary line to below the knee, worn constantly for four or five months, crutches and an elevated shoe on the well foot being furnished. This was followed by a plaster bandage which allowed freedom at the knee and later by a lighter appliance. The children, even with an elevated shoe, constantly laid aside their crutches, allowing the full weight to fall in walking or at play upon the diseased hips.

In 100 cases, 3 with double hip disease, there were 69 with ab-

<sup>1</sup> Sinding Larsen, *Nordiskt, Med. Archiv*, 1905-1906.

scesses; 99 cases were treated conservatively, but in 29 of them it was found necessary to excise the hip; in 4 cases excision was performed at once. The ultimate functional result of the cases or mortality is not given, but the high abscess rate and the large percentage of resection is noteworthy. The mortality of hip disease in the German Surgical Clinics, according to the statistics published by Dollinger<sup>2</sup> from various surgical clinics is as follows: In suppurative cases, 27 per cent. were cured; 24 per cent. were not cured; 48.8 per cent. died. In non-suppurative cases the mortality was 16.5 per cent.

Cazin reported a mortality in 80 suppurative cases at the sea-coast hospital, of Berck sur Mer, of 12.5 per cent.; 55 per cent. were cured. Menard<sup>3</sup> at the same institution recently reports even better figures: 1321 cases both suppurative and non-suppurative; 95 deaths, 54 in cases not operated upon; 41 in cases operated upon (that is, excision), 7 per cent.

The treatment at Berck is at present chiefly recumbent treatment, with plaster-of-Paris bandages, fixation, and largely out-door exposure in the day time on a portable frame.

The chief cause of death was tuberculous meningitis, 1 out of 56. Tuberculous meningitis was as common in cases operated upon as in cases not operated upon. The deaths from hip disease proper, that is, when other tissues were not involved, were few.

Mortality statistics quoted by Whitman<sup>4</sup> are as follows: At Tübingen, 40 per cent.; Kiel, 48.59 per cent. non-operative cases, 53.96 per cent. operative; at Marburg, 35 per cent. non-operative cases, 40.4 per cent. operative cases; at Heidelberg, 46.6 per cent. non-operative cases, 58 per cent. operative cases; in Zurich, 37.7 per cent. non-operative cases, 54 per cent. operative cases; in Vienna, 17 per cent. in all cases; in Göttingen a mortality of 40 per cent. Rabi reports a mortality of 20 per cent. in a large number of cases, some of which, 14 per cent., were still under treatment. At the Alexandra Hospital, in London, the mortality was 26 per cent.

Statistics of the ultimate functional results may be quoted as follows: Dollinger: in 14 cases, 2 walked with an excellent gait, 3 fairly well, 3 limping badly, 1 requiring cane and apparatus, 1 requiring cane, 1 with a slight limp, 1 in a poor condition, and 1 bed ridden. The average shortening from 4 to 8 cm. There was pathological dislocation in all. On the average the trochanter was 2 to 3 cm. above Nélaton's line, in several cases as much as 6 cm. No mention is made of motion, or of absence of deformity. The usual percentage of abscesses in hip disease is estimated as 50 per cent. by Whitman.

<sup>2</sup> Joachimsthal's Handbuch.

<sup>3</sup> Etude sur coxalgie, Paris, 1907.

<sup>4</sup> Treatise on Orthopedic Surgery, third edition, p. 391.

It appears, therefore, that as far as can be judged by statistics, the traction treatment employed at the Boston Children's Hospital is justified by superior results. If these figures showing the superiority of the results obtained in cases in which efficient traction is employed as a principle of treatment, as compared with those in which traction is not used, are not sufficiently convincing, further evidence can be offered in the figures collected by V. P. Gibney<sup>5</sup> at the Hospital of Ruptured and Crippled, New York. In the first series, 80 cases without mechanical or operative treatment, there was deformity in almost all cases. In 107 cases treated by mechanical means, not always efficiently, there was recovery without marked flexion. The mortality in Dr. Gibney's service, 288 cases, was 12 per cent. The mortality in the clinics of American cities is reported by Whitman as 12.5 per cent.

It should not be assumed that the results obtained by traction at a large civic hospital, treating largely the poorer classes with imperfect home nursing, indicate what can be accomplished if this principle of treatment is more thoroughly applied. Aseptic surgery is often imperfectly conducted in a crowded dispensary, but the results obtained are enough better than those obtained if all attempts at asepsis were discarded, to make all attempts to prevent sepsis obligatory. It is also true that better results in the treatment of hip disease are gained if the principle of traction is recognized than if it is ignored, even if the application is not as thoroughly or constantly applied as is desired. If the muscular force crowding the head of the femur into the acetabulum be estimated in a given case as a pressure of fifteen pounds and a distracting force of five pounds is applied for the greater part of the time, it may be sufficient to prevent the complete distraction of the femur and of the acetabulum and dislocation. The less pull, and the less constantly it is applied, the poorer the results. When bone destruction has already taken place in neglected cases, the results are not so good as those followed more carefully from the first. Among intelligent people and the well-to-do, with the best nursing facilities, better results are obtained in chronic cases.

Experience has justified the expectation of perfect recovery after thorough treatment, if this is undertaken before the disease has disorganized the tissue to a considerable extent. This expectation is justified in pulmonary consumption, and it is equally true in hip disease. In coxitis there is, however, the advantage for the surgeon that he has directly under his control the means of checking the irritating causes which delay cicatrization of the tuberculous tissue.

This belief is supported by the results obtained by the late C. F.

<sup>5</sup> Med. Record, March 2, 1878.

Taylor,<sup>6</sup> of New York. 94 cases, of which 24 were suppurative cases, of these 17 recovered with ample motion (82 degrees to 18 degrees); in 14 cases perfectly useful limbs thoroughly healed; in 5 the limbs were useful, but sinuses remained; 2 died. Satisfactory recovery occurred in the non-suppurative cases, except in 1 who was killed in an accident after having been run over. L. A. Sayre<sup>7</sup> also reported admirable results in the treatment of his private cases.

The following cases coming under personal observation may be of interest illustrating the value of traction in cases in which the final observations were made several years after the end of treatment:

CASE I.—C., a girl, aged eight years, treated in Paris by recumbency in a gouttiere de Bonnet for left hip disease for six months; later, in 1877, came under the care of the late Dr. C. F. Taylor, of New York. At this time the patient was suffering from pain and sensitiveness. Traction was applied by Dr. Taylor with much thoroughness for a period of a year and a half. A large abscess developed in the upper part of the thigh; it evacuated itself. The patient wore a convalescent splint for several years. She was seen in 1903, over twenty years after the cessation of treatment, and was found to be in perfect health; there had been no sinus subsequent to the healing of the abscess twenty-two years before. Motion in flexion was over 90 degrees; abduction 30 degrees. The limb was strong, useful, and undistorted; the trochanter was below the Roser Nélaton's line. As an evidence of the extent of the early epiphyseal disease there was a shortening from arrest of growth of the femur of one and one-half inches. The patient was a healthy married woman.

CASE II.—G., a boy, at the age of six years, in 1884, was seized with right tuberculous coxitis of a severe type while living in Paris. He was treated by portable recumbency, at gouttiere de Bonnet, for two years; afterward ambulatory treatment was gradually permitted and encouraged, followed by massage and electricity. At the age of twenty-one years, that is, in 1899, he returned to America with a thoroughly cured hip, but with bad deformity. There had been no abscess, but ankylosis in a faulty position had occurred with flexion of the thigh at nearly 90 degrees and 30 degrees adduction. There was marked pathological dislocation. The head of the trochanter was from two to three inches above Nélaton's line. The patient walked with a disfiguring limp. A subtrochanteric osteotomy with fixation in a strongly abducted position was performed with success, giving a useful limb and but little disfigurement of gait.

CASE III.—O., a girl, at the age of five years, in 1879 developed tuberculous osteitis of the left hip of a severe type. She was treated

<sup>6</sup> Mechanical Treatment of Disease of the Hip-joint, Boston Med. and Surg. Jour., March 6, 1879.

<sup>7</sup> New York Med. Jour., April 30, 1892.

from the first by means of traction, at first temporarily with recumbency, later with an ambulatory traction splint. An abscess developed and evacuated itself, leaving a sinus. Three years following the disease of the left hip the patient was attacked by a similar process in the right hip. Traction was no longer necessary on the left hip and the child was placed upon a double Thomas splint with abduction of both hips with a weight and pulley traction on the right. The child was at this time taken to Switzerland and remained abroad for several years. The traction on the right hip was discontinued and the child was carried about on a mattress in a light basket. An abscess developed in the right hip and sinuses in both hips discharged for some time, but finally healed. In 1900 the patient was examined; there was a flexion deformity of both hips to an angle of 90 degrees; no adduction. Both sinuses had healed; 10 degrees of motion in flexion was present in the left hip and no pathological dislocation; in the right hip no motion was present and there was marked pathological dislocation. The patient was able to walk about freely and subsequently married and later gave birth to a healthy child.

CASE IV.—D., a boy, aged seven years, in 1880, developed severe disease of the right hip; severe night cries were prominent early symptoms. He was placed under efficient treatment, including traction with recumbency at first and later ambulatory treatment with traction. The case was a suppurative one; an abscess formed and evacuated itself, leaving a sinus which persisted for years and finally healed. A traction splint was worn for two or more years, but a convalescent splint was not worn constantly and a permanent flexion deformity of 45 degrees with adduction of 30 degrees developed gradually. This was corrected by means of a subtrochanteric osteotomy. Fixation in an abducted position was performed in 1905 with excellent result. On examination at this time there was stiffness at the hip-joint, but no pathological dislocation.

CASE V.—L., a girl, aged four years, in 1882, developed left hip disease without severe symptoms. Ambulatory traction treatment was carried out with thoroughness for three years. The patient was cured, was examined twenty-one years later and was found to have recovered with nearly normal motion of flexion, slightly restricted abduction, no pathological dislocation, a perfectly useful limb, but with an arrest of growth of the femur and a shortening of one and one-half inches.

As cases under exceptional care do not furnish a good basis for statistical comparison, I have not attempted to obtain the ultimate results in a large number of the cases treated outside of hospital practice in an experience in orthopedic practice of thirty years, and no statistics of those cases are offered. I wish, however, after a careful trial, without bias, of all methods of treatment, both operative and conservative, to record my conviction of the

great superiority of the conservative method in tuberculosis of hip-joint; of the great advantage of traction applied during the more acute stage to the point of distraction of the bones of the joint; and of the importance of protecting the joint from ambulatory jar for some time following the subsidence of all acute symptoms. There are three obstacles to the satisfactory cure of hip disease: (1) Tuberculous meningitis, best combated by fresh air and activity; (2) septic infection, best avoided by delaying operative interference; and (3) deformity, best avoided by proper mechanical treatment including, as of great importance, traction.



FIG. 10



FIG. 11

FIG. 10.—Child wearing the abduction traction hip splint. (Bradford.)

FIG. 11.—Rear view of the abduction traction splint applied. (Bradford.)

A valid objection to the employment of traction splints is that they are elaborate and expensive, and require special skill in nursing, beyond the reach of the general practitioner. The justice of this criticism has been so evident that many attempts have been made to simplify the apparatus needed for the efficient application of traction. It is thought that the traction splint in use at the Children's Hospital for the last three years is an improvement both in efficiency and simplicity on appliances of the sort similarly employed for the purpose of traction.

The accompanying illustrations (Figs. 10, 11, 12, 13, 14, 15, and 16) indicate the nature of this apparatus. It can be said to be but little more complicated than the well-known Thomas knee-splint, which it resembles, with the additional attachment of a perineal half-ring pressing to the well side and determining the amount of abduction, and a windlass attachment furnishing traction. The apparatus has the advantage that it does not need constant watching of the perineal straps, and that there is less chafing at the perineum

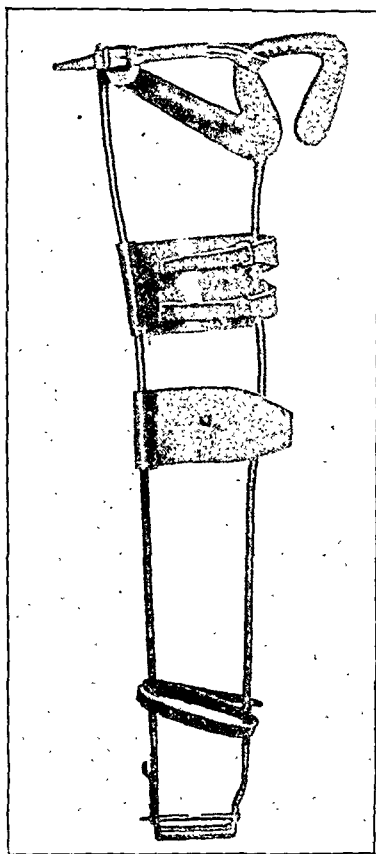


FIG. 12

FIG. 12.—Abduction traction splint padded. (Bradford.)

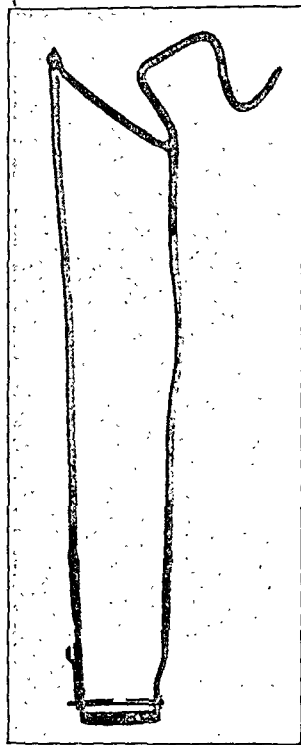


FIG. 13

FIG. 13.—Abduction traction splint without padding or straps. (Bradford.)

than when straps are used. It requires no skilled nursing. The cost of the appliance is not great and it can be readily made by any skilled blacksmith. Other forms of traction have been used and attempts have been made to simplify the windlass traction attachment; the substitution of buckles and straps has frequently been tried, but the requisite gradation of pull is not well furnished by a buckle and strap attachment. A simple spindle with a drop-ring catch can be made to answer in the place of the one used in the



Children's Hospital, although the latter will be found more convenient and but slightly more expensive. If it is remembered that when traction is needed in the acuter stages some delicacy of adjustment is needed to avoid increasing muscular spasm, the difficulty of using

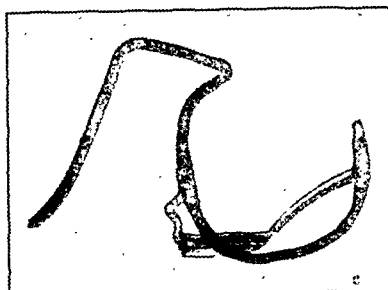


FIG. 14.—Curve of the wire of the upper rings of the abduction traction splint. (Bradford.)

buckle and strap traction satisfactorily will be seen. In fact it may be said that no conclusion as to the results to be obtained from the traction treatment in the acute stage can be drawn when buckle and strap traction is employed. With the abduction perineal rings properly



FIG. 15.—Experiment showing the amount of fixation of the hip-joint from traction, with a strong pull endurable by the patient; no motion at the fractured hip-joint; the pelvis sways with movement of the leg, with the traction reduced one-half; motion of only 15 degrees in abduction and 7 per cent. flexion was possible. The less the pull the more the motion. (Bradford.)

adjusted, there is no soiling the splints which are not removed when the patient uses the closet. When the stage of the affection is reached where traction is not needed, the apparatus can be used simply as a perineal crutch, the traction attachment being discarded with or without the removal of the abduction addition. The splint is prevented

from slipping off by a strap passing over the shoulder, as in the Thomas knee-splint.

In the early stage crutches are furnished as an additional aid in locomotion, but they may be discarded at the will of the patient.

It is manifest that traction is only needed during a certain stage of hip disease, namely, the stage when there is exaggerated muscular spasm, which can be estimated by palpation of the adductor muscles, which in the more acute stages are in a state of spasm. As has been stated, during the acuter stages, it is desirable that the patient



FIG. 16.—Showing the amount of plaster-of-Paris spica fixation. A motion of 15 degrees in abduction and 10 degrees' flexion is possible at the hip-joint, when the bandage is carried to the mammillary line. (Bradford.)

be kept in a recumbent position and prevented from the trauma of jar or twist, including exaggerated muscular pressure. This is done by means of the traction splint indicated, but it can also be accomplished by the application of a weight and pulley. This, however, requires for satisfactory efficiency the fixation of the patient upon a frame in addition to the weight pull. Weight pull should only be used temporarily.

The importance of protecting the joint from jar during the convalescent stage is theoretically clear, but is often neglected in practice

for the reason that the patients suffer no pain and desire to be freed from all encumbrances, both crutches or splints. An irritation or weakness persists, due to occasional traumatism, in the partially recovered joint, which promotes the later development of deformity, that is, flexion and adduction (Figs. 17, 18, 19, and 20).

The two following cases serve to illustrate the value of splint protection of the hip:



FIG. 17

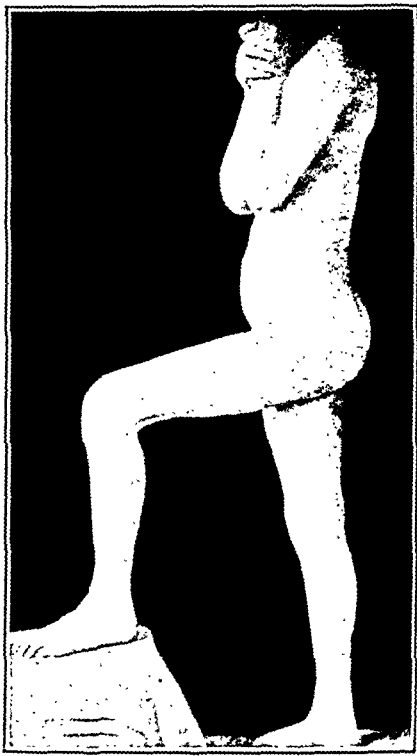


FIG. 18

FIG. 17.—Hip disease cured with traction treatment. Treatment was begun before there was extensive bone destruction. (Bradford.)

FIG. 18.—Same as Fig. 17, showing the range of motion. (Bradford.)

CASE VI.—A young man, aged twenty-two years, was seized with severe disease of the right hip while a student at the medical school. With the aid of crutches and a traction splint he was able to continue his studies after six months' interruption. Traction after a year became unnecessary to relieve symptoms. He was bebarred from hospital service by crutches and needed as he learned from experience some form of protection from the jar of locomotion. With a hinged ischiatic crutch he was able to enter upon arduous hospital duties and the hard work of early practice. His perineal crutch, uncomfortable on account of weight, was gradually discarded, but was for years needed to check the body jar of active loco-

motion. Recovery without deformity, with no dislocation, with slight hip motion, and a strong limb, followed.

CASE VII.—H., a man, aged twenty-four years, had suffered from hip disease since he was ten years of age and had recovered to the extent that he was able to walk about with crutches; was free from pain, but had several sinuses. He was, however, dependent upon crutches and was therefore debarred from a bread-winning occupation. He was furnished with a hinged ischiatic crutch, which was fitted with some difficulty, but finally made comfortable and worn

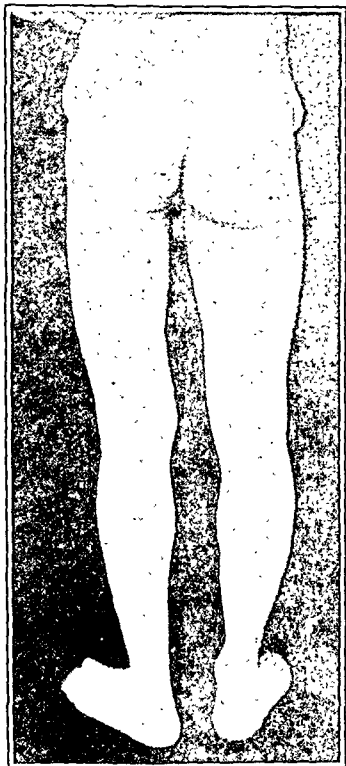


FIG. 19



FIG. 20

FIG. 19.—Cured hip disease—twenty years after the cessation of treatment. Fig. 2 shows skigram of this patient; there is one inch shortening, but no deformity. (Bradford.)

FIG. 20.—Cured hip disease—twelve years after the cessation of traction treatment. A strong, useful limb without deformity. (Bradford.)

for six years as a necessary means of locomotion without which walking for any time was followed by pain and cramps. He was able to secure an important position of trust requiring activity. He subsequently was able to discard his appliance and remained in good health enjoying active usefulness and dying at the age of forty years of an acute disease.

CONCLUSIONS. It may be said that the surgeon has within his control several methods of treatment for hip disease. He can aid in the protection of the joint simply by the use of crutches,

he can aid in furnishing the patient facilities for increased activity and fresh air—the antidote to tuberculosis. He can, if he desires, prevent deformity and limit, if not prevent, bone destruction by exaggerated bone pressure, thereby checking the process and promoting bone healing.

The test of his success in treatment will not be the recovery of the patient, but the amount of resulting deformity. The aim of the surgeon in the treatment of any case without existing bone distortion should be a cure without distortion or disability. The elevation of the trochanter above the Nélaton line, adduction, abduction, or flexion, indicate that the surgeon either undertook the case too late to secure the best possible results, or that he was unable to apply thoroughly the methods of relief at his command (Figs. 19 and 20).

Traction can be employed without using expensive or elaborate apparatus; it does not demand unusual skill in nursing or from the surgeon, or more attention in the direction of the case than is within ordinary possibilities.

It can be claimed: That traction meets a pathological indication during the acute stage, that is, the stage of muscular spasm; that when used it should be applied with the purpose of furnishing distraction, that is, checking undue bone crowding; that when efficiently applied it furnishes a satisfactory measure of fixation of the joint; and that when traction is employed better results are obtained than when it is not made use of during the course of treatment of hip disease.

Patients with hip disease placed under favorable conditions recover; the death rate is low; there is no malignancy in the disease. Besides fresh air and proper nutrition, protection from jar and joint crowding are to be reckoned among the favorable conditions.

When traction is employed at an early stage and during the more acute period in a large number of cases, fewer abscesses will occur and these will heal more readily; better functional results are obtained, and a greater number of useful limbs; there is less deformity; pathological dislocation can be prevented in more cases; more cases recover with serviceable motion—than when the employment of traction is ignored or applied imperfectly.

## THE HEART IN PULMONARY TUBERCULOSIS.

### I.—THE HEART ITSELF NOT DISEASED.

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THE study of the heart in pulmonary tuberculosis will always remain a subject of the greatest importance and interest, as it yields information of great value in regard to diagnosis, prognosis, and treatment. The subject naturally divides itself into two sections, according as to whether or not the heart itself is diseased. In this paper that section will be discussed which deals with the heart itself not diseased, while a later paper will take up the second section, which has to do with disease of the heart as well as of the lungs.

Under this division the following points will be taken up: (1) The position of the heart; (2) the size of the heart; (3) dilatation, mentioning briefly the area of cardiac dulness; (4) auscultatory phenomena; (5) the pulse, mentioning briefly blood pressure; and (6) palpitation.

**THE POSITION OF THE HEART.** The position of the heart in patients with pulmonary tuberculosis depends directly upon the pathological changes that have taken place in the lungs. In the incipient stages the heart is rarely appreciably displaced, but in many patients in moderately and far-advanced stages the ordinary methods of exploration show some change in the position of the heart. In a clinical study of 2344 tuberculous cases at the Phipps Institute<sup>1</sup> the heart was said to be displaced in only 57 instances, 2.4 per cent.; on the other hand, Pottenger<sup>2</sup> thinks it is exceptional to find the heart in its normal position in advanced chronic tuberculosis. Adhesions often prevent the dislocation of the heart when we are led to expect it.

It is readily seen that the displacement of the heart may be much more pronounced when the right lung is affected, for the displacement is most often associated with contraction of one lung. In right apical lesions of some standing, even when the physical signs are slight, the right border of the absolute cardiac dulness may be found three-quarters to one inch or more to the right, or about the middle of the sternum. This Turban<sup>3</sup> considers "a typical and cardinal symptom" of tuberculosis of the right apex. Displacement of the heart to the right attracts our attention much more quickly than displacement to the left, on account of the difficulty of determining the exact boundary of the contracting lung and heart.

<sup>1</sup> Second Annual Report, Philadelphia, 1906, 239.

<sup>2</sup> Diagnosis and Treatment of Pulmonary Tuberculosis, 1908, 83.

<sup>3</sup> The Diagnosis of Tuberculosis of the Lungs, 1906, 81.

When extensive cavity formation has occurred on the right, when the right lung is the seat of fibrosis consecutive to pulmonary tuberculosis, or, as some affirm, to pleurisy, or a pneumothorax or a pleuritic effusion supervenes upon the left side, the heart may frequently be entirely upon the right side. Pulmonary tuberculosis is by far the most frequent cause of non-congenital dextrocardia, but this usually develops only when the left lung is slightly affected and is not bound down by pleuritic adhesions. It is, however, not common in pulmonary tuberculosis, but five instances being mentioned in 2344 cases at the Phipps Institute.<sup>4</sup> This dislocation may occur gradually, but in a few instances seems to take place suddenly, and the patient's attention is drawn in a short time to the fact that his heart is on the wrong side. Sudden transposition is probably due to the giving way of slight adhesions or to sudden changes of pressure in the pleural cavity: for instance, that produced by acute pneumothorax. Several years ago a patient of mine, with extensive cavity formation on the right side consulted me about his heart, which he said he had suddenly found on the right side. I had not seen him for some months, as he had been at work, and at the last examination I had noted no change in the position of the heart, although some must have been present. When I examined him I found the point of maximum impulse visible and palpable in the fourth interspace, on the right, just inside of the mid-clavicular line. There was a wide area of pulsation, and the dulness attributed to the heart was all to the right of the sternum and extended out as far as the anterior axillary line and above to the third rib. The patient continued at work, but suffered more and more from dyspnoea, which at last became extreme, and he was compelled to give up work two days before his death. At autopsy the pericardium was firmly bound down and extended on the right to about the anterior axillary line, above to the second intercostal space, and slightly to the left of the mid-line. The right lung, about one-third its normal size, was completely excavated. In another patient the dextrocardia was due to the same cause.

Young,<sup>5</sup> of Boston, has recently reported a case in which a gradual transposition of the heart occurred. Meyer,<sup>6</sup> of Hoboken, has had 3 cases of dextrocardia, all in fibroid phthisis, 2 of which occurred suddenly.

In an interesting case of valvular pneumothorax from the rupture of the wall of a cavity in the lower part of the left upper lobe the heart was a number of times gradually forced over on the right side, but it always returned when a needle was introduced and the air allowed to escape.

Marked displacement of the heart occurs much more frequently

<sup>4</sup> *Loc. cit.*

<sup>6</sup> Personal communication.

<sup>5</sup> Boston Med. and Surg. Jour., 1907, clvii, 791.

to the left than to the right, due, possibly, to the fact that the tension when the left lung contracts is exerted more directly upon the heart. For these reasons a very frequent displacement of the heart is upward and slightly outward. The heart, however, may be so greatly displaced to the left, following contraction of the left lung, or pneumothorax or pleuritic effusion on the right, that the apex may be beyond the left anterior axillary line or in the third intercostal space.

The heart is rarely displaced directly upward and more rarely directly downward. Mendl and Selig<sup>7</sup> have found the heart more perpendicularly placed.

**THE SIZE OF THE HEART.** The heart has been held by different authorities to be small, large, or normal in size in pulmonary tuberculosis.

*The Small Heart.* Since Laennec<sup>8</sup> first announced that the heart is small in pulmonary tuberculosis many famous authorities have argued for and against this belief. Beneke<sup>9</sup> is said by Blumenfeld to have been the first to prove by autopsy that the heart is small in pulmonary tuberculosis, and Brehmer<sup>10</sup> the first to hold congenital hypoplasia to be the cause of pulmonary tuberculosis. Hutchinson<sup>11</sup> believes that the heart is small and approaches the size that is normal at puberty, due, he suggests, to an arrested development similar to that which he holds takes place in regard to the shape of the chest. Many theories have been advanced to account for the smallness of the heart which undoubtedly exists in a number of patients who have died of pulmonary tuberculosis. It has been attributed to a poor appetite (Rokitansky<sup>12</sup>), impoverished nutrition (Potain<sup>13</sup>), cachexia (Louis,<sup>14</sup> etc.), atrophy or degeneration of the heart substance (Ratner<sup>15</sup>), lessened amount of blood and fewer erythrocytes (Stokes<sup>16</sup>), or to several of these factors.

Postmortem observations are not entirely satisfactory for the solution of this problem, for, as some affirm, antemortem changes in the size of the heart cannot always be detected at necropsy, but the musculature can be much more accurately measured. However,

<sup>7</sup> Prager med. Woch., 1907, xxxii, 529.

<sup>8</sup> De l'auscultation médiate, Paris, 1819, ii, 291.

<sup>9</sup> Quoted by Blumenfeld, Spec. Diæt. u. Hyg. d. Lungen.- u. Kehlkopfschw., Berlin, 1897, 72.

<sup>10</sup> Die Aetiologie der chronische Lungenschw., etc., 1885, 143; and Die chronische Lungenschw., 1869, 57.

<sup>11</sup> Med. Record, 1906, 340.

<sup>12</sup> Manual of Pathological Anatomy, Swaine's translation for the Sydenham Society, 1854, i, 316.

<sup>13</sup> Quoted by Norris, loc. cit., Gaz. hebdom. de méd. et de chir., 1891, 441.

<sup>14</sup> Recherches anatomico-pathologique sur la phtisie, 1825, 54.

<sup>15</sup> Du cœur dans la tuberculose, Thèse, Paris, 1898 (quoted by Sequer, Le cœur des tub., Thèse, Paris, 1903, p. 9).

<sup>16</sup> Diseases of the Chest, Dublin, 1837, 414; Diseases of the Heart and Aorta, Phila., 1855, 546.



it may be, Reuter<sup>17</sup> (1884), in 261 autopsies (on patients with pulmonary tuberculosis), found a small heart in 29 per cent. of the men and in 56 per cent. of the women. Spatz<sup>18</sup> found a small heart in 327 autopsies with a tendency to hypertrophy of the left ventricle. Sequer,<sup>19</sup> in 270 autopsies, found the heart small in 24.5 per cent. of 200 men and in 50 per cent. of 70 women. This atrophy occurred more in young patients with rapidly fatal ulcerative processes and tuberculous enteritis. It was more pronounced than in carcinoma, due, he believed, to a smaller amount of blood and to less blood space. Norris<sup>20</sup> thinks that in uncomplicated pulmonary tuberculosis the heart is often subnormal in size, due to atrophy of its substance, and not to congenital hypoplasia.

More recently considerable work has been done to clear up this point, and the orthodiagraph and more exact methods of comparing the size of the heart to that of the body have been employed. Bouchard and Balthazard<sup>21</sup> with such methods have found that in men the heart at first is small but later is enlarged (hypertrophy and dilatation), while in women this is not so marked. Sciallero,<sup>22</sup> by use of the *x*-rays, decided that in the young and in those with recent lesions the heart is small and behind the sternum. During the past year Mendl and Selig<sup>23</sup> have stated that the heart is small in comparison to the body.

*The Large Heart.* If, as Krehl<sup>24</sup> believes, the same amount of blood is driven through the lungs until the pulmonary vessels are reduced three-quarters in volume, it is readily seen that the remaining vessels must increase in size or dilate, or pressure in the pulmonary artery will increase, the right ventricle hypertrophy, and the second sound at the pulmonic area become accentuated. The factors occurring in pulmonary tuberculosis and leading to hypertrophy are pleural adhesions, emphysema, a reduced capillary area, whether due to pulmonary fibrosis or sclerosis, or possibly to marked infiltration and complications, such as nephritis, arteriosclerosis, etc. Few observations indicating enlargement of the heart in pulmonary tuberculosis have been made until recently, and even some of these authorities have attributed the hypertrophy in many cases to alcohol (Bauer and Bollinger,<sup>25</sup> Reuter<sup>26</sup>) or nephritis (Sequer,<sup>27</sup> Norris<sup>28</sup>). Hypertrophy occurs more frequently in men (due some say to alcohol), more often in the fibrous form, and accord-

<sup>17</sup> Ueber die Grössverhältnisse des Herzens bei Lungentuberkulose, Dissert. München, 1884.

<sup>18</sup> Deut. Arch. f. klin. Med., 1882, xxx, 138.

<sup>19</sup> Le cœur des tuberculeux, Thèse, Paris, 1903.

<sup>20</sup> AMER. JOUR. MED. SCI., 1904, cxxviii, 649.

<sup>21</sup> Le cœur des tuberculeux, Rev. de la tub., 1903, x, 1.

<sup>22</sup> Semaine méd., 1902, xxii, 377.

<sup>23</sup> Clinical Pathology, translated by Hewlett, 1905.

<sup>24</sup> Quoted by Norris, loc. cit.

<sup>25</sup> Loc. cit.

<sup>26</sup> Loc. cit.

<sup>27</sup> Loc. cit.

<sup>28</sup> Loc. cit.

ing to Sequer<sup>29</sup> more often in older patients, who emaciate slowly. Renal tuberculosis has not been found to cause hypertrophy (Sequer,<sup>30</sup> Reuter<sup>31</sup>). In some recent experiments on rabbits by Hellin,<sup>32</sup> it was found that excision of one lung led to compensatory enlargement of the other and hypertrophy of the heart. The difference between these animals and patients with pulmonary tuberculosis, especially in an advanced form, lies in the fact that in the animals the musculature (general and cardiac) was normal, the volume of blood not reduced, and there was no toxemia present. Whether these factors are sufficient to explain why hypertrophy is not more frequent, I shall have to leave open. Palthier,<sup>33</sup> indeed, believes that hypertrophy occurs only when pathological changes are found elsewhere in the body.

Norris<sup>34</sup> states that enlargement of the heart (hypertrophy and dilatation) is said to occur five times more frequently at postmortem (about 12 per cent.) than clinically (as determined by percussion and auscultation). Reuter<sup>35</sup> found an enlarged heart in 40 per cent. of the men and in 20 per cent. of the women; Hirsch,<sup>36</sup> in 44 per cent.; Lebert<sup>37</sup> in 21 per cent. of those with chronic and 13 per cent. of those with acute disease; and Sequer<sup>38</sup> in 50 per cent. of the men and 16 per cent. of the women who came to autopsy. In 200 autopsies at the Phipps Institute<sup>39</sup> hypertrophy was present 13 times, 6 times of the left ventricle, 2 of the right, and 5 of both. These statistics are based upon autopsy findings, and most of the authorities state that the hypertrophy is found chiefly in the right ventricle.

The clinical statistics bearing upon the size of the heart are meagre. From the elaborate table of circulatory disturbances in pulmonary tuberculosis published by the Phipps Institute<sup>40</sup> no idea of the size of the heart from clinical observations can be obtained. At the Adirondack Cottage Sanitarium the heart was normal in size in the vast majority of 1289 patients, and only in 8, 6 of whom had valvular disease, was hypertrophy noted.

The diagnosis of enlargement of the heart in far advanced stages, when fibrosis and contraction or emphysema are often pronounced, must, if made, rest upon the accentuation of the pulmonic second sound and increased epigastric pulsation or, indeed, the use of the x-rays. If the general nourishment be maintained at par or be increasing, if the general blood pressure remain normal, and if there be rapid heart action and an accentuation of the second pulmonic

<sup>29</sup> Loc. cit.

<sup>30</sup> Loc. cit.

<sup>31</sup> Loc. cit.

<sup>32</sup> Arch. exper. f. Phar., 1906, iv, 21.

<sup>33</sup> Contribution à l'étude anatomo-pathologique du cœur dans la phthisie chronique, Thèse, Paris, 1890 (quoted by Sequer, loc. cit.).

<sup>34</sup> Loc. cit.

<sup>35</sup> Loc. cit.

<sup>36</sup> Deut. Arch. f. klin. Med., 1899, lxiv, 615.

<sup>37</sup> Berl. klin. Woch., 1867, 233.

<sup>38</sup> Le cœur des tuberculeux, Thèse, Paris, 1903.

<sup>39</sup> Third Annual Report, Phila., 1907, p. 163.

<sup>40</sup> Loc. cit.

sound, cardiac hypertrophy is in all probability taking place, even though absent on clinical examination (Emerson<sup>41</sup>). Reuter<sup>42</sup> believes that a "bad" heart renders an individual more susceptible to tuberculosis and states that Bollinger<sup>43</sup> called his attention to the fact that cattle are more susceptible to tuberculosis than horses in which the heart is relatively almost twice as large.

Woods Hutchinson<sup>44</sup> has shown that all classes of animals with a relatively small heart in proportion to their body weight are very susceptible to tuberculosis, while others of the same general, with proportionately larger hearts are almost immune. This holds true he states, for birds or mammals, herbivora, carnivora, or omnivora.

*The Heart Normal in Size.* Variations from the normal are much more apt to occur in later than in the earlier stage of the disease, and in most patients in the earlier stage of the disease the heart is normal in size. In the majority of patients Sokolowsky<sup>45</sup> believes the heart is normal in size, and my observations on patients in the earlier stages of the disease lead me to the same conclusion. Later in the disease the heart may remain normal, as Sequer<sup>46</sup> found at autopsy in 25 per cent. of men and 33.3 per cent. of women, Harris and Beale<sup>47</sup> in 64 per cent., and Reuter<sup>48</sup> in 30.7 per cent. of men and 23.2 per cent. of women. Sciallero<sup>49</sup> found, by the use of the x-rays, the size of the heart to be normal in older patients and in those with chronic and benign lesions.

It may be stated then that congenital hypoplasia is infrequent, that the heart in the majority of early cases is normal in size, and that with progression of the pulmonary lesion the heart may, in the order of frequency, atrophy, hypertrophy, or remain normal in size.

**DILATATION.** Dilatation of the heart occurs far less frequently than would be supposed, and, as is to be expected, late in the disease. Laennec,<sup>50</sup> Louis,<sup>51</sup> and others noted it as exceptional. It has been found more in acute types of the disease (Brun-Bordeaux<sup>52</sup>), especially when they occur in patients with chronic fibroid changes. In acute miliary tuberculosis of the lungs dilatation and hypertrophy of the right ventricle are not rare, and are essentially a mechanical result, due to the impeded pulmonary circulation. Sequer,<sup>53</sup> in 271 autopsies, found it present 21 times in patients with fibroid, 7 times in patients with ulcerative forms. At the Phipps Institute<sup>54</sup> dilatation of the right heart was noted clinically in 9 per cent. of 1491 patients, usually in a far advanced stage, and at autopsy in

<sup>41</sup> Personal communication.

<sup>42</sup> Quoted by Reuter, loc. cit.

<sup>43</sup> Klinik der Brustkrankheiten, 1906, 237, 397.

<sup>44</sup> Treatment of Consumption, 1895, 201.

<sup>45</sup> De l'auscultation médiate, 1819, ii.

<sup>46</sup> Recherches anatomico-pathologique sur la phthisie, Paris, 1825, 51.

<sup>47</sup> Contribution à l'étude des maladies du cœur droit dans la phthisie, Thèse, Paris, 1877 (quoted by Sequer, loc. cit.).

<sup>48</sup> Loc. cit.

<sup>49</sup> Third Annual Report, 1907, pp. 39, 163.

<sup>42</sup> Loc. cit.

<sup>43</sup> Loc. cit.

<sup>44</sup> Loc. cit.

<sup>45</sup> Loc. cit.

24 per cent. of 200 cases. Jaccoud<sup>55</sup> has frequently found dilatation. According to Norris,<sup>56</sup> it occurs clinically in 32 per cent., at autopsy in 21 per cent. of patients with pulmonary tuberculosis. He explains this difference by the fact that retraction or consolidation of the lung increases the area of heart dulness, that most of the very ill patients remain in bed and so relieve the heart, and further, that extreme emaciation, usually present at death, affects the heart also.

In fibroid phthisis, in which emphysema, pulmonary sclerosis, and pleural adhesions tend to diminish the field of hematosiis and the respiratory area, the tension is increased in the pulmonary artery, dilatation of the right side of the heart occurs, and tricuspid insufficiency, venous stasis, œdema, and asystole all hasten the end, which occurs more from the condition of the heart than from that of the lungs. The reserve force is said to be lessened in pulmonary tuberculosis. Dilatation of the right side (both auricle and ventricle) is often accompanied by hypertrophy of the right ventricle, which Jaccoud believes is favorable.

The area of cardiac dulness was rarely changed in 1289 patients at the Adirondack Cottage Sanitarium unless some valvular disease was present. In fact, all murmurs were classed as functional when there was no change in the area of cardiac dulness and when no definite cardiac symptoms were present. In 55 patients absolute cardiac dulness was noted as absent. In 2 patients the area of relative cardiac dulness was increased to the left, in 1 the disease was on the left, in 1 on the right, but neither patient was considered to have had valvular disease.

Patton<sup>57</sup> states that in tuberculous toxemia a dilatation of the conus arteriosus may occur, the apex impulse may be weak and diffuse, a systolic bruit may be present over the pulmonary area, and the pulse may be weak and empty.

**AUSCULTATORY PHENOMENA.**—Careful auscultation of the heart reveals, in a certain proportion of patients with pulmonary tuberculosis, some deviation from normal. A study in regard to the heart of 1289 patients at the Adirondack Cottage Sanitarium showed that 65 per cent. presented some slight variation from normal in their history or physical examination, while for the various stages the figures were: incipient, 63.5 per cent.; moderately advanced, 64 per cent.; and far advanced 79 per cent. (only 24 cases).

Much stress has been laid by Flick<sup>58</sup> and his fellow-workers upon the frequency with which the second pulmonic sound is accentuated. In 1491 patients, chiefly in far advanced stages, it was found accentuated in 664 (45 per cent.), and in 26 per cent. the aortic second

<sup>55</sup> *Traité de pathologie interne*, 1871, ii, 93.

<sup>56</sup> *Second Annual Report, Phipps Inst.*, 1906, 243.

<sup>57</sup> *Colo. Med. Jour.*, 1904, x, 261.

<sup>58</sup> *Third Annual Report, Phipps Inst.*, 1907, 39.

sound was accentuated. In 967 (75 per cent.) of our 1289 patients the heart sounds were found of normal relative intensity (the second pulmonic slightly louder than the second aortic sound). In the remainder the second pulmonic sound was accentuated 69 times (in 5 per cent. of the whole), and the second aortic was louder than the second pulmonic sound in 65 (5 per cent. of the whole). A weakened first sound is rather frequent in well-advanced stages, and is often more pronounced during acute attacks.

Functional murmurs were present in 81 patients (6 per cent.) of 1289 at the Adirondack Cottage Sanitarium, and in 17 patients (2.6 per cent.) of 639 at the Phipps Institute,<sup>59</sup> but the latter were in much more advanced stages when such murmurs would seem more likely to occur. At the Phipps Institute<sup>60</sup> the murmurs were heard 10 times at the base (7 over the pulmonic area) and 7 times at the apex. At the Adirondack Cottage Sanitarium the murmurs were about equally divided between the apex and the base (37 and 38), but at the base the murmur was much more frequent in the pulmonic area (including those in which the murmur was heard with greatest intensity over the pulmonic area, 35 times, and over the aortic area only 3 times, all systolic in time). In 6 patients the murmur was equally intense at both mitral and pulmonic areas. The murmur was widely transmitted, due, no doubt, in some cases to consolidation, in 10 of the apical and 6 of the basal (pulmonic) murmurs. At the apex the murmur was systolic in time in 33, diastolic in 3, and both diastolic and systolic in 1. Over the pulmonic area the murmur was noted as "presystolic" once. In 6 instances the murmurs were stated to be cardiorespiratory, but many more undoubtedly belonged to this class. In 3 patients a pleuro-pericardial friction rub was noted; in 2 it was systolic in time (once over the mitral, once over the tricuspid area), and in 1 diastolic, over the pulmonic area. A systolic whiff due to compression of a cavity during systole is not very rare and murmurs may be produced in cavities by the systolic distention of a large vessel or of an aneurysm.

In one male patient, a clerk aged thirty-seven years, denying lues, using little alcohol, and doing clerical work, a continuous murmur almost musical in character, with a systolic intensification, was heard over a wide area on the right back, with its maximum intensity opposite the seventh vertebral spine and 3 cm. from it. It was loudest just before the end of the expiration and decreased during the first part of inspiration. The x-ray examination showed no especial increase of shadow, the heart was apparently normal, cyanosis was absent, and the pulse normal. A diagnosis was made of pressure upon the great vessels by a tuberculous gland. The

<sup>59</sup> Third Annual Report, 1907, 40.

<sup>60</sup> *Loc. cit.*

patient had a slight consolidation of the right upper lobe and has done well.

A systolic murmur in the subclavian artery, first described by Stokes, is not infrequent, but is probably due to compression of the artery, and consequently is not connected with the heart.

Reduplication of the heart sounds has been rarely noted at the Adirondack Cottage Sanitarium, occurring 14 times (1 per cent.) in 1289 patients. It occurred in connection with the second sound at the pulmonic area in 3 cases, with the second sound at the apex in 3, with the first in 1. In 2 the second sound at the base and in 1 the second sound at the apex and base was reduplicated. At the Phipps Institute<sup>61</sup> the first mitral sound was reduplicated in 4 per cent. (of 652 patients) and the pulmonic second sound in 2.5 per cent. (of 652 patients).

Irregularity in the heart action and the skip of a beat is infrequent in early stages (6 per cent. at the Adirondack Cottage Sanitarium), and apparently less common in late stages (4 per cent. in 635 patients at the Phipps Institute<sup>62</sup>).

The radial vessel wall was noted as palpable or thickened in 74 patients (5.7 per cent.), 17 of whom were over forty years and 9 over forty-five years of age. According to the stages it was found in the incipient 21 times (4 per cent., 2 over forty-five years of age), in the moderately advanced 50 times (6.6 per cent., 6 over forty-five years and 13 over forty years), and in the far advanced 3 times (12 per cent., 1 over forty years, 1 over forty-five years).

**THE PULSE.** The frequency and the tension of the pulse in pulmonary tuberculosis are early and often permanently changed. The size of the pulse, its fulness and regularity, bear less definite relation to the pulmonary disease than the frequency and tension, and often until the late stages are only slightly if at all abnormal. The radial pulse is said to be influenced by the position of the arm on the affected side when contraction of the apex has occurred. Foss<sup>63</sup> has found paradoxical pulse in 61 per cent. of 120 patients, while Sorgo<sup>64</sup> noted a weaker pulse on the affected side in 8 per cent. of 397 patients.

*Frequency.* The frequency of the pulse has been observed from antiquity, and until thermometry was introduced this was the most important single phenomenon in this disease. Since the use of the clinical thermometer has become so common, less attention has been paid to the study of the pulse. Unquestionably it is in pulmonary tuberculosis nearly as important as the temperature, and in many cases is far more accurate for prognosis. The pulmonary patient borders constantly upon the verge of excitement, and the visit of the physician or a call at his office will often increase the pulse

<sup>61</sup> Loc. cit.

<sup>63</sup> Fortschritte d. Med., 1904, xxii, 99.

<sup>62</sup> Loc. cit.

<sup>64</sup> Wien. klin. Woch., 1904, xvii, 1337.

twenty beats a minute. The best record is that taken at the patient's home by a nurse to whom he is accustomed. This instability of the pulse, so marked in many cases, has some connection with the decrease of blood pressure and a paresis of the vessels. Altitude increases somewhat the pulse rate, which may decrease in a short time or persist.

Increased frequency of the pulse is often a striking feature in pulmonary tuberculosis and is of great value in diagnosis, as it stands most often in direct relation to the activity and extent of the disease and strength of the patient. The majority of all patients have at first a slightly increased pulse rate (90 to 100), even when apyretic, and frequently when at rest in bed. The pulse rate and temperature may be independent, but more usually there is a rather close connection between the two, which some have tried to express by allowing ten beats for each degree of fever. An increase above this rate they think is due to cardiac weakness. Forced feeding may produce slight acceleration of the pulse for a time. In some cases the pulse shows increased rapidity for short periods, but this is rather unusual, as when it once becomes rapid it usually remains so for some time. Mental excitement, slight physical exercise, attacks of coughing, and a full meal have a strong tendency to increase the heart beats in early as well as in advanced cases. In the latter, however, the pulse tends to be constantly rapid, and, varying somewhat with the temperature, increases slightly every afternoon. The range is usually between 88 and 120. This tachycardia is seldom noticed by the patient. Often as the patient improves, and after the temperature has become normal, the pulse rate gradually decreases, but it may quickly fall to normal and remain so. Slight tachycardia may persist in healed pulmonary tuberculosis.

The cause of the increased frequency is still unsettled. It has been attributed to pressure upon the vagus by enlarged tracheo-bronchial lymph nodes, an explanation which certainly does not suffice in many cases. Brehmer<sup>65</sup> thought the underdevelopment of the heart and the overdevelopment of the lungs is an important factor. Another view is that it is due to the increased work thrown upon the heart by a narrowing of the lumen of the pulmonary vessels, or to a narrowing of the air passages, which Marie found diminished the number of respirations and accelerated the heart. A neuritis of the vagus, the fall in blood pressure, irritation of the sympathetic, increased irritability of the cardiac ganglia or muscle fibers, myocarditis, anemia, and dyspepsia, have all been suggested as factors. The most probable cause, especially in incipient stages, is a weakening of the cardiac muscle and its nervous control, due to the tuberculous toxin, but this hardly explains the persistent tachycardia in

<sup>65</sup> Die chron. Lungenschw., 1869, 57.

some healed patients. Valvular disease of the heart in pulmonary tuberculosis exerts little influence upon the pulse rate.

*Blood Pressure.* The blood pressure in many cases of pulmonary tuberculosis is lowered from the very outset and some have held that hypotension is present in the predisposed. A much greater variation between the blood pressure in a reclining and in an upright position exists in pulmonary tuberculosis than in health (Emerson<sup>66</sup>). Potain believes that this hypotension can be used to differentiate a true chlorosis from the secondary anemia of tuberculosis, but a study of our cases by A. F. Miller does not uphold this statement. The hypotension is held by many to be due to the tuberculin, which, in large doses, undoubtedly lowers tension (Teissier<sup>67</sup>). Small therapeutic doses do not exert this effect. As the disease advances and pronounced constitutional symptoms occur, the blood pressure becomes less and less, and 90 mm. Hg. (Riva-Rocci manometer, with a nine inch cuff) is not uncommon. When the pulmonary tuberculosis is complicated with emphysema, nephritis, arteriosclerosis, diabetes (Teissier), or cardiac hypertrophy, the blood pressure may be raised. Naumann<sup>68</sup> thinks that most hemoptysis occurs in patients in the early stages with transitory high pressure, but he used Gaertner's tonometer, and assumed a rather low pressure as normal.

*PALPITATION.* In the 1289 patients there was a history of palpitation at some time in 271 (21 per cent.), but it is a rare thing for patients in early stages to complain of this symptom. It is said to be more frequent at puberty and at the menopause, sometimes to precede hemoptysis and to accompany dyspepsia. Considering the neurosis present in many patients palpitation is not as frequent as would be expected.

## THE HEART DURING THE EARLY PERIOD OF CONVALESCENCE FROM ACUTE INFECTIOUS DISEASE.<sup>1</sup>

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THE condition of the heart, together with its proper management in the early period of convalescence following acute infectious disease, is without doubt a subject of very great importance to every practitioner of medicine. Nor has the importance of this subject been ignored. In every special treatise on heart disease and in every

<sup>66</sup> Loc. cit.

<sup>67</sup> Des lésions de l'endocarde chez les tuberculeux, Paris, 1894, 103.

<sup>68</sup> Zeit. f. Tub., 1903, v, 118.

<sup>1</sup> Read at a meeting of the American Climatological Association, Boston, June 9, 1908.



book on the practice of medicine some reference is made to it. I am obliged to remark, however, that frequently what is written or stated is insufficient, by reason of the small amount of space that is allotted to its consideration, or because the rules for our guidance which are laid down are too general, and their lack of specific directions in given instances make them relatively of little value. And yet, that the medical mind is certainly alive to the necessity of greater attention and care in behalf of convalescents, is evident, as shown by an appeal made occasionally for funds to build a hospital for them, or insistence through letters to medical periodicals speaking of the dearth and of the need of such institutions. Despite this, preventive medicine and the rules which should govern us intelligently, so as to ward off, or protect from, acute infectious diseases, have received far more thought and work, it seems to me, than the care and treatment of those who leave ill beds where such diseases have previously prevailed.

I would not be understood as in any sense deprecating the well-deserved labor given to the former by men of the broadest mind and most intelligent grasp. All I would do is to contend forcibly for the judicious help and guidance of those who deserve, in my judgment, equal study and equal thought. It is perhaps Utopian—certainly in our life and time—to hope to abolish entirely acute infectious disease. It is not Utopian, once the disease has occurred and been battled with successfully, during the acute period, to contend daily and continually for a sufficient length of time against its normal or complicating sequels.

In this connection I take it that no organ of the body more frequently requires our wisest government than the heart. Upon prevention of cardiac dilatation depends mainly all future vigor and well-being in a very large number of instances. Not that we should ignore the other organs; not that we should not consider carefully the recuperation of the system in general; not that we should not pay strict attention to brain fag, to nerve exhaustion, to muscular debility, to powers of assimilation, to general nutrition. Granted all this, and yet the heart easily stands out primarily and essentially among all, in the great majority of instances. This is true, notably, in typhoid fever, in diphtheria, in influenza, in pneumonia, and in scarlet fever. It is equally true and even more so in acute articular rheumatism. In the latter disease, however, the frequent accompaniments of cardiac degeneration or cardiac dilatation are so apt to be more or less pronounced endocarditis, or pericarditis, that we have a problem which is somewhat unlike that connected with the other acute infectious diseases referred to.

In what follows, in view of limited time, I shall be obliged to omit many facts and details of very great interest, and confine myself as closely as possible to some salient cardiac features which are more or less common to the diseases mentioned. In all of them the heart

muscle and the nerves governing heart action are, as a rule, affected organically, if the disease be at all severe and if it lasts its usual period. By reason of the divers toxic elements of each one of these diseases, more or less cloudy change and fatty degeneration, as well of heart muscle as of nerve fibre, may be found. Numerous small lymphoid cells are often shown in the interstices of the muscle fascicles. The separate muscle cells are swollen, and often the nuclei have disappeared. The muscle cell shows granular or fatty degeneration, and the striæ are less well marked. The muscular fibers are sometimes ruptured. The degeneration may be general throughout the heart, or limited and more pronounced in certain areas, and the rest of the heart be comparatively intact so far as is observed microscopically. Sometimes and at a late period of the acute stage of disease, the heart muscle has become hyaline, or even fibrous in certain portions. Fatty infiltration of the cardiac nerves and cloudiness of nerve sheath and irregularity of the cylinder axes are not infrequently noticed at autopsies. The heart is flaccid—the walls thin many times—or there may be occasional hypertrophic dilatation. The color varies from the sere and yellow leaf hue to a reddish brown color. The heart in both instances is easily torn. Endocarditis and pericarditis are rare—at least of pronounced degree. There may be a slight endocarditis of the cardiac walls, which has not extended to the valves, or there may be a little beading of the free margin of the mitral valve which has not gone farther and may, and usually does, disappear with time. Cardiac thrombi are often found, especially in the right heart, which is distended. These thrombi may be soft, cruoric, gelatinous; frequently in diphtheria and pneumonia they are fibrinous in great part and formed probably some hours, or days, previous to death.

In making autopsies after acute infectious disease, it is essential not to confound pathological lesions due to other and preceding causes with those due to the infectious disease we are investigating. This is especially true of the lesions of a preëxisting myocarditis, subacute or chronic, which might be mistaken for those due to the immediately previous infectious disease, unless we are very careful and rigid in our examination and interpretation of what we find. And even when we are most painstaking, there are conditions at times, so far as the heart is concerned, almost on the border line, and we cannot say precisely what has occasioned them. In those instances, particularly, in which the postmortem findings have to do with scarlet fever which has been complicated during life with marked rheumatic manifestations, or those of suppurative arthritis, the evident lesions of endocarditis, simple or ulcerative, or pericarditis dry, serous, or suppurative, will surely indicate the complicating dyscrasia.

From these considerations it is shown that at times the pathological lesions of the heart are various, and nerves, muscle, vessels

are more or less affected, and in a more or less advanced degree of pathological change, due to a combination of causes. Hence our affirmations as to what is and what is not caused by the previous acute infectious disease must be made guardedly. It is, however, highly probable in a given instance, and when the acute infectious disease has been grave, or prolonged, that myocarditis relatively acute is thus occasioned, and not by some doubtful cause acting a length of time previously and little by little.

One of the most obscure and unsatisfactory findings up to date, is what relates to cardiac reports in autopsies following influenza. Frequently, if not always, we are in great doubt as to what is result of influenza and what is due to previous or complicating disease. Moreover, about the correct diagnosis of the influenza we are often in great doubt. The bacillus which is regarded as characteristic of the disease by some physicians is of doubtful value to others, and to them does not establish the identity of the disease. Many cases of so-called "la grippe" are not "la grippe" at all. They are simply cases of ordinary tonsillitis, pharyngitis, bronchitis, otitis.

In those instances of heart weakness, or sudden death following acute infectious disease, we frequently assume that the cardiac muscle is degenerated, or, indeed, at the autopsy we find the evidence of it to the eye and to the microscope. On the other hand, while we may find evident cardiac dilatation postmortem, there is present, properly speaking, no organic changes in the heart. Now then, while we attribute heart failure to degeneration of muscular or nerve fiber when it exists, what do we say in those cases in which both muscle and nerves reveal nothing abnormal? It seems to me we must at least admit ignorance on our part as to what is the real cause of cardiac weakness at times, since muscular or nervous degeneration would only explain cases when it exists.

The cardiac thrombi often contain the bacteria of the disease and are a distinct menace to life, not only by reason of their mechanical transport, but also because of the metastatic abscesses which they give rise to in different structures and organs.

Such changes, briefly, are what we find at autopsies in these diseases. It is fair to assume that during life, in minor degree at least, similar pathological conditions exist even after the acute stages of the disease are passed and the patient has entered into what may be fairly termed the early convalescent period. This period is considered to be that during which the temperature has returned to the normal, the pulse is approximately the health standard, the appetite returns, and increased strength and vitality become more evident. The patients begin to express the desire to get out of bed. A little later, and after being out of bed for a few hours each day, they wish to go out of the room, or down stairs, and later to go out of the house for a drive or walk. When is the proper time for permission to do these things, and upon what symptoms or signs

should our judgment be based, especially so far as the heart is concerned—the most important of all the organs in this determination, as a rule? From my own observation, study, experience, I would specially emphasize the importance of what follows, as a guide, in a measure, of sane conduct in a given case.

In typhoid fever, I do not believe, as a rule, it is wisdom for the patient to sit up in bed even for a short time, for several days—usually a week or ten days—after the temperature has reached the normal. I do not believe he should leave his bed until he has sat up in bed several times at least, and finally without causing any very considerable changes in his heart action and in his pulse. If sitting up in bed causes much increased rapidity of pulse, with irregularity and occasional intermittences, the indication is to go slowly and make the sitting up very little, or not at all, for a while. If combined with these indications from the pulse there is a soft blowing, systolic, mitral murmur at the heart covering the first sound and combined with, or not, accentuation of the pulmonic second sound; if, without any mitral murmur, there is notable weakening and lack of tone to the first sound; and if with, or without, murmur the heart action is feeble, rapid, irregular, and now and then intermittent, I should deem the patient safer flat on his back than even sitting up in bed.

What is stated as regards sitting up in bed is true again when the patient has been permitted to get out of bed, to walk into an adjoining room, or to go down stairs. We should expect, the first time a patient sits up in bed, or gets out of bed, increased rapidity of pulse and frequently a blowing systolic murmur indicative of mitral inadequacy. But in a day or two, or a few days at most, the pulse should be less rapid, and while the blowing murmur may be still present the heart action is more forcible and the pulse less depressible. Again, if we take the blood pressure with Janeway's sphygmomanometer, there ought to be relatively moderate difference between what is noticed while still in dorsal decubitus, or sitting upright in or out of bed. Otherwise, we wisely cry a halt to any exertion at all, physical or mental. If the temperature, instead of being normal, is subnormal—down to  $97^{\circ}$  to  $97.5^{\circ}$ —I object to the patient's leaving bed, as a rule. If, with lowered temperature, the urine is also of markedly low specific gravity (1000 to 1010), and if I know it was normal in health and had kept a good specific gravity during the acute period of the disease, and if its quantity is lessened, or not at all increased, I most strongly object to the patient's getting out of bed, or, at all events, walking from one room to another. Subnormal temperature, with urine of low specific gravity and lessened quantity, and perhaps slightly albuminous, adjoined to increased rapidity of heart action and pulse and lowered force of both (with or without a mitral murmur), and with or without notable irregularity or intermittence of both heart

and pulse, means inadequate heart strength. When instead of increased rapidity of pulse and heart, notable slowness of both occurs, I am even more solicitous and careful of my patient, and dread more the advent of sudden heart failure. I have seen this come on after very slight exertion in both conditions, and be ushered in with sudden faintness and great pallor; or, again, the lips and finger tips became notably blue and cold. With these signs the patient had marked dyspnoea and a sense of goneness. By means of immediate stimulation, such states are usually recovered from rapidly, with only the passing fright remaining to remind one still to be very careful and watchful for some time to come. Later, and when the patient had been out to walk or to drive, and apparently seemed fairly well and strong, suddenly such an attack as that just described would occur again, and frequently without any evident cause. Again, some slight overexertion would be the obvious accidental cause.

Following attacks of the sort described, I have examined the heart carefully. Sometimes I have been convinced by physical exploration, notably by percussion and palpation, that the heart was dilated and that this dilatation was seemingly acute in nature. Again, while I believe such dilatation was present, it was difficult, even almost impossible, to demonstrate it. Behind this dilatation, when present, we should see cardiac muscular fibres and cardiac nerves which are still suffering, as a rule, from structural disease—in the way of cure, but not yet recovered. Are these cases due to both systems affected—the muscular and the nervous—or may we separate them? Occasionally I have thought I could. When I have seen a patient get out of bed, go downstairs, or go out and drive or walk, and return to bed later and feel better and stronger for the exertion, and show it by higher specific gravity of urine, normal temperature, even slight increase of it (99° to 99.5° F. under tongue), increased blood pressure, and stronger and more regular pulse, I have been convinced that the cardiac nervous system and not cardiac muscle, might be at fault functionally or organically. The soft blowing mitral systolic murmur may exist for many weeks.

Finally, and when the other cardiac signs and symptoms were practically normal during the convalescent period, I have come to the conclusion that the murmur was due not to mitral regurgitation through lack of closure of the orifice caused by want of cardiac power, but to improper or badly coördinated nervous control of the cardiac systole. I have been of this opinion, and it has been strengthened when the patient found that if he used his mental faculties except in very moderate degree, both his eyes and brain were sensibly fatigued.

Of course, to any one recovering from typhoid fever, particularly, who has fallen a victim to the disease when his previous life had been preëminently an intellectual one (lawyer, clergyman,

scientist, etc.), it is especially desirable during convalescence to avoid or limit continuous mental effort. The powers of the mind come back slowly and, in my observation among the last, and I do not believe that the heart itself will often work absolutely well unless the cerebrum be also healthy structurally and functionally.

Is there any period of duration as to the possibility of fainting attacks during convalescence; as to the development of more or less cardiac inadequacy due to dilatation and caused immediately by muscular or nervous cardiac changes? In general terms there is not. It may last weeks, months, years. Such cases must be managed with the greatest care, watchfulness, knowledge, patience. Time alone, with proper hygienic conditions of pure air, pure food, proper rest, recreation, and many hours of sleep in the twenty-four, will bring the patient out as well as ever. Drugs may be used beneficially in proper amounts during the acute attacks. Of these none is so valuable as *strophanthus*, by the mouth or hypodermically, and followed immediately with the best brandy, whiskey, or ammonia. Subsequently, strychnine is useful in certain cases, coca in others, and digitalis also in a few instances, in small or moderate doses—especially the infusion made from fresh English leaves.

Personally, I have never tried the Nauheim treatment, natural or artificial, in the early convalescence from acute infectious disease. It has, however, been vaunted, by one physician at least, even in the acute stage of typhoid fever, and later in a convalescent patient from this disease with an extremely weak heart. A modified artificial Nauheim treatment, called the siphon method by Albert Abrams,<sup>2</sup> has demonstrated its favorable action by giving the pulse increased strength in such a patient. I am very glad to report, also, that Dr. Philip King Brown,<sup>3</sup> of San Francisco, has made use of the Nauheim bath treatment in several cases of pneumonia and typhoid fever in their acute stages, and speaks favorably of the results obtained, especially in pneumonia, as compared with those effected by drug stimulation. The average blood pressure was notably "higher and better sustained on the days that baths were given than on the days that drugs were given." It would be fair, therefore, to assume from this that we should obtain as satisfactory and even better results from the use of the Nauheim baths in the early convalescent period; but of this I have no experience, nor can I record that of others. It is for the future to decide.

In the later convalescent period of certain cases of influenza and typhoid fever, particularly when the heart remains weak and slightly dilated, I am confident that the Nauheim treatment, wisely given by experts, is often of unquestionable and great value.

In a suggestive and eminently practical paper, Dr. W. Parker

<sup>2</sup> Medical News, March 16, 1901.

<sup>3</sup> American Medicine, 1906, pp. 325-331.

Wooster<sup>4</sup> directs attention lately to the great value of affusions and other methods of using hydrotherapy in the convalescent period from *any* disease, "when death seems imminent from heart failure and when free stimulation with drugs had been made." More or less ineffectually affusions increase arterial tension and restore resistance in vessels when the heart requires them urgently.

In instances of sudden heart failure occurring during the early convalescence of acute infectious disease, suprarenalin or adrenalin by the mouth in tablet triturates, each containing  $\frac{1}{20}$  grain, or preferably in hypodermic solution of 1 to 1000, is unquestionably very useful, as has been frequently observed. Personally, however, I have learned to place great reliance upon tincture of strophanthus by mouth and hypodermically, and I do not feel like abandoning it at present for the newer drug, until I am satisfied it is more advantageous under like circumstances: in view of the fact that strophanthus acts almost wholly as a very rapid and efficient heart stimulant, whereas adrenalin acts almost as much in contracting small peripheral bloodvessels and thus raising vascular tone as it does in giving power to the heart itself. This double action, it seems to me, might be prejudicial instead of beneficial in those cases in which there is no vasomotor paralysis and which do not require the heart to be stimulated by increased functional vascular power.

Finally, I cannot emphasize too strongly the major importance as a remedial agent of rest. This rest must be absolute in extreme cases and frequently prolonged many days and many weeks. After typhoid fever, pneumonia, diphtheria, influenza, scarlet fever, it is important, as already noted, but after an attack of acute articular rheumatism the infectious nature of which is now certain, although the special microbe causing it is not yet universally accepted, it is the *sine qua non* of prophylactic treatment and of that of the disease. And why? Simply because without it the numerous cardiac lesions will inevitably occur; these fill our hospitals and our dispensaries, and are usually hopeless, so far as cure is concerned, and frequently are most distressing cases. Among the results of acute articular rheumatism, neglectfully or foolishly treated, cardiac dilatation accompanying and caused by chronic myocarditis is by far the worst sequel. Of course, it may be, and frequently is, accompanied by and aggravated by chronic valvular disease, but it is the chronic myocarditis and not the valvular disease *per se* which makes the outlook to the patient and to the physician most deplorable. All this, many, many times, may be prevented in great part, if not entirely, by rest: rest for the body, as for the mind, rest absolute and continuous for days and for weeks. I am very glad to add that nowhere is this absolutely essential treatment insisted upon with more force and ability than

<sup>4</sup> New York Med. Rec., June 6, 1905, p. 942.

in a paper read before the American Medical Association in June, 1907, by Dr. S. Solis Cohen, of Philadelphia.

Great or even moderate mental strain should be avoided during several months at least; the same is true of severe, continued bodily exertion. Either one or the other may occasion cardiac dilatation little by little, or suddenly. In either case the condition is often irremediable and sets up heart disease which will last as long as life lasts, and usually gets continuously or intermittently worse, though it may be held stationary at times and for a while. To the neglected or careless and ignorant management of the early convalescent period following acute infectious disease is due, in my judgment, the larger proportion of chronic cardiac disorders of most distressing disabling, and finally fatal, character from which youth and adult life suffer.

The immediate risk to life is probably greater in the convalescent period of diphtheria than it is in the other acute infectious diseases, and more than one sad, deplorable event has occurred in my experience. Not always do deaths follow when there has been ignorance or negligence. Despite all judicious care and proper management, unfortunately, they occasionally occur, and, moreover, when practically, during days or weeks, there had been no warning note or previous threatening symptom. Sudden cardiac paralysis occurs and the end comes, rapid almost as the lightning stroke. Again, there may be a slow, gradual asthenia, which nothing seems to conquer, and which, in final analysis, and allied with other paralytic symptoms, seems to be evidence of extensive cardiac degeneration of muscle and nerves.

In scarlet fever, the complicating nephritis of the third or fourth week of the disease throws additional strain upon an already weakened heart, and thus dilatation, or hypertrophy with dilatation, is occasioned. Whenever to the nephritis of scarlet fever during the early convalescent period marked rheumatic manifestations are added, we should be fearful lest endocarditis or pericarditis should endanger the heart already weakened and dilated. To guard this heart effectually, we should make use of the ice bag or hot water bag to the precordial region and give salicin internally, in moderate or large doses.

In croupous pneumonia, as I have shown previously more than once, we should guard our patients especially against blood clotting, which is prone to occur—more so than in any other acute infectious disease with which I am familiar. This we may do effectually by means of carbonate of ammonium judiciously given, or by means of citric acid agreeably administered as lemonade. As to the poison of la grippe, I have no special counsel to give other than to state that I believe a moderate amount of quinine, or, better still, cinchona bark, in the form of the compound tincture, is valuable as a general tonic, and possibly has special value as a protection against cardiac



dilatation. Certain it is that we cannot be too careful in the management of the early period of convalescence following "la grippe." How often do we see or read of patients who have apparently recovered from the acute attack of the disease, are without fever, whose appetite and strength are partially recovered, but who have a sudden relapse? They go out of the house, expose themselves to the weather, return to their accustomed pursuits, and for a few days or weeks, seemingly, they improve continuously and, indeed, are almost well; sometimes without obvious cause, sometimes as the immediate consequence, apparently, of mental or bodily strain, they become re-infected with the poison of the disease and are soon weak and prostrate again, and more so than during the original attack. In these instances sudden death occasionally occurs. Now, whether it be the threatening and weakened condition of the patient from the renewed grippal attack which alarms us, or whether it be the sudden death thus occasioned which shocks us, we may be sure that it is the weakened, structurally altered heart, or profoundly disturbed, functionally deranged central organ, which is the principal agent or precursor of long, painful invalidism or sudden fatal termination.

The prognosis of a given case during the early convalescent period must depend very much upon the previous health of the patient, and especially upon the previous condition of his heart. If the patient be young and hitherto well, the prognosis is usually fairly good, even though the infectious disease has been of severe type—barring untoward accident or complication. On the other hand, if the patient be near or past middle life, we should be more anxious. This is true especially of pneumonia and influenza, and more than of typhoid fever and diphtheria, mainly because the two former diseases attack the middle-aged more frequently than the other two. But in any particular case we are specially anxious, either because, knowing the previous history, we believe it possible or probable that there has been already a preëxisting myocarditis before the attack of the infectious disease, or because we know positively this condition, with or without valvular disease of the heart, has preëxisted. Under these latter circumstances the prognosis is notably graver, and frequently, as we know, both in pneumonia and influenza, the patient dies rapidly or suddenly during the early convalescent period, and the death is undoubtedly caused directly by cardiac degeneration.

As to any special drugs other than those I have mentioned being useful to shorten the infectious disease or ward off irretrievable disaster, I know of none except what are usually termed tonics. Of these, iron in some form is occasionally useful when there is evident anemia during the early convalescent period after infectious disease, caused or not by it. Incidentally the iron may strengthen

the weakened heart to resist dilatation, if not already present, to lessen it possibly, or prevent its increase, if it has already developed.

Finally, I would insist that when we consider that apart from rheumatism, syphilis, alcoholism, continued bodily strain, with poor food and hygiene, cardiac dilatation, acute or slowly developed, is mainly occasioned by ignorant, injudicious, careless treatment of the early convalescent period following acute infectious disease, we must recognize the immense importance of my subject to every practitioner of medicine. Inasmuch as I believe cardiac dilatation is a preventable disease in these instances, its importance is only still greater.

NOTE.—Since writing my paper I am delighted to know that by the will of the late W. W. Smith, architect, of New York City, the bequest of nearly \$3,000,000 is made to St. Luke's Hospital Corporation, New York City. Mr. Smith stipulates that the money be applied "to the care and relief of needy convalescent patients recovering from acute diseases and surgical operations and from these and other causes requiring care and treatment not obtainable in their homes, and without regard to religious belief or sex." Noble man, noble gift!

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### NON-FATAL COMA IN THE COURSE OF DIABETES.<sup>1</sup>

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THE case of diabetes here reported was observed clinically for a period of nine months. The patient developed coma, from which she recovered, and four months later died in hemiplegia. Postmortem examination was made. The opportunity to follow such a sequence of events being comparatively uncommon, the report is thought to be of sufficient interest to add to the records now accumulating with regard to coma in diabetes as well as coma in general.

*Report of the Case up to the Development of the Coma (In Brief).* A woman, aged forty-eight years, was admitted to the City Hospital, February 27, 1907. Her complaint was nausea. Syphilis had been contracted, but when was doubtful. The patient was of feeble mentality; talkative. There was considerable thirst, large appetite, and other symptoms of diabetes, which seemed to have existed for about two years. There was a moderate degree of general arteriosclerosis. Chart I presents the urinary findings up to the time the coma developed.

<sup>1</sup> Read at a meeting of the Association of American Physicians, Washington, D. C., May 12 and 13, 1907.

CHART I.—COMA IN COURSE OF DIABETES. RECORD PRIOR TO COMA.

Date.	Amount in c.c.	Specific Gravity.	Albumin.	Cast.	Reaction.	Sugar.		Acetone.	Diacetic acid.	Urea in grams.	Symptoms.	Weight in lbs.	Diet.
						Per cent.	Amount in grams.						
Feb. 22	2800	1038	+	+	Acid.	2.5	70	+	0	16.8	Those common to diabetes of about three years' duration. In addition, patient is feeble mentally and has arteriosclerosis. Feb. 13 and Mar. 31, slight incontinence of urine.	—	Restricted. Consisting largely of beef-juice, eggs, and milk.
" 25	1860 +	1030	+	+	"	2.8	—	+	0	15.7		—	
" 27	2400	1037	+	+	"	3.5	84	+	0	14.7		—	
Mar. 5	2400	1037	+	+	"	3.5	74	+	0	19.2		101-5	
" 7	2203	1030	+	+	"	3.7	82	+	0	22.3		—	
" 10	2450	1027	+	+	"	2.3	50	+	0	21.7		—	
" 13	2650	1032	+	+	"	2.9	77	+	0	15.2		—	
" 19	1460 +	1028	+	+	"	2.6	—	+	0	19.6		102	
" 25	2550	1028	+	+	"	—	—	+	0	18.4		103 5	
Apr. 12	960 +	1030	+	+	Neut.	—	—	—	—	—		—	
" 28	2480	1025	+	+	"	—	—	—	—	22.32		—	

*Report of the Coma.* For the first two and one-half months after the patient was admitted a detail examination of the urine was recorded (Chart I). This was then discontinued until June 3, when the house physician reported that the patient had recently become irritable, had refused to save the urine, and had considerable diarrhœa, which had resisted ordinary remedies. For several days past (June 3) she had complained of weakness and muscular pain, especially in the back. She frequently fell asleep in her chair. There was some incontinence of urine and feces (diarrhœa) at these times. On the day previous (June 2) she had slept in her chair the greater part of the day, but would arouse as persons approached, and remain awake while they conversed with her. On June 4 the drowsiness markedly increased; she responded only when shaken, and then complained in a heavy manner of general pain, and quickly lapsed into her former conditions. There was incontinence of urine and feces. The breathing was audible, like that of one in deep sleep. It was never labored or irregular, that is, no dyspnœa (Kussmaul) was observed. June 5, the patient could not be aroused. Alkaline treatment was instituted on this date: Milk diet; bicarbonate of sodium, xxx grains (2 grams) by mouth every hour; saline enemas, one pint (500 c.c.) every six hours; hypodermoclysis (saline), one pint (500 c.c.) twice daily. If the urine remained acid to litmus or the patient's condition did not improve, bicarbonate of sodium was to be administered subcutaneously and intravenously. If an alkaline reaction of the urine appeared, the quantity of bicarbonate of sodium was to be reduced. Chart II presents the urinary findings during the coma.

It will be observed in this table that during the coma the specific gravity fell; the volume for twenty-four hours was about the same as that before the coma; the reaction was acid until June 8; the sugar was much reduced; acetone and diacetic acid were present in small quantity and  $\beta$ -oxybutyric acid was absent; ammonia was low; indican was not increased and there was a moderate amount of albumin and occasional casts. With the clearing of the coma the diacetic acid and acetone disappeared (in this order), the amount of sugar and the specific gravity increased. The urine remained acid to phenolphthalin, but on June 8 was alkaline to litmus. This, together with the lessening of the coma, contra-indicated an increase in the amount of alkali to be administered. About 2070 grains (150 grams) had been given in three days, in addition to saline enemas and hypodermoclysis. If an acidosis of any severity were present in this case, it is evident that the amount of alkaline administered was insufficient to counteract it. The alkalizing of the urine, however, indicated that sufficient alkali had been administered to overcome such acidosis as was present. The importance of this, as a diagnostic point, will be referred to again.

CHART II.—COMA IN COURSE OF DIABETES. PERIOD OF COMA

Date.	Amount in c.c.	Specific gravity.	Albumin.	Casts.	Acidity in terms of 1/10 N. HCl.	Reaction.	Sugar.				Acetone.	Diabetic acid.	$\beta$ -oxybutyric acid.	Indian.	Total grams N. in 24 hours.	Ammon. per cent. of total N.	Total amt. ammon. N. in grams in 24 hrs.	Symptoms.	Treatment.	Diet. Total fluids.
June 3	1500	1030	+	+	—	Acid	—	—	—	—	—	—	—	—	—	—	—	Onset of coma: irritability; weakness; muscular pains; asleep in chair most of day; arouses and converses as persons approach; refuses to save; urine or obey orders; diarrhoea.	Plan for alkaline treatment: sod. bic., gr. xxx every hour by mouth; saline enemata. Oj every 6 hours; hypodermoclysis, saline 500 c.c. b. d., until urine is alkaline; intrav. and subcut. sod. bic. if condition is worse.	Milk and water 38 ounces.
"	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Developing coma: asleep most of the day; responds only when shaken, then lapses into former state; no Kussmal respiration.	Alkaline treatment begun: sod. bic., gr. xxx every hour by mouth, 23 doses (690 gr.); saline enemata. Oj every 6 hours (2 qts.); hypodermoclysis, saline (500 c.c.).	Milk, 34 oz. Water, 110 oz.
"	6	1080 1030	+	—	—	Acid	—	—	—	—	+	+	—	—	—	—	—	Coma continues: somewhat less marked; incontinence urine; specimen obtained by catheter.	Sod. bic., gr. xxx every hour by mouth, 23 doses (690 gr.); saline enemata. Oj every 6 hours (2 qts.).	Milk, 38 oz. Water, 36 oz.
"	7	1478 1028	+	+	—	Acid	—	1	14.78	0.00193	0.00048	0	0	—	—	—	—	Coma lessening: heavy but can be aroused; "sleeps" all day.	2070 gr. sod. bic. by mouth; 6 qts. saline enemata; 500 c.c. saline subcutaneously in 3 days.	Milk, 30 oz. Water, 42 oz.

"	81680	1022	+	+	—	Alk.	2.5	—	45.36	+	+	0	—	—	Coma clearing: sleeping lightly all day.	Sod. bic., gr. xxx by mouth, 3 doses (90 gr.); saline enemas, Oj every 6 hours (2 qts.).	Milk, 52 oz. Water, 40 oz.
"	91350	1009	+	+	+2.5 c.c.	Alk. lit. acid phen.	0.69	1	13.50	0.0116	0.2299	0	0.6.04	10.6.641	Coma clearing: brighter but still drowsy.	"	Milk, 18 oz. Water, 66 oz.
"	101410	1009	+	+	+0.6 c.c.	Alk. lit. acid phen.	0.46	0.52	7.32	0.00348	0	0	0.5.66	8.3.470	Coma clearing: brighter falls asleep when left alone.	"	Milk, 62 oz. Water, 12 oz.
"	111920	1010	+	+	+3.0 c.c.	Alk. lit. acid phen.	0	0.68	13.05	0.00464	0	0	0.6.23	13.8.860	Coma clearing: can be aroused easily.	"	Milk, 72 oz. Water, 2 oz.
"	121710	1014	+	+	+2.8 c.c.	Alk. lit. acid phen.	0.69	0.66	11.7	0	0	0	0.8.85	14.0.1.22	Disappearance of coma: tried to get out of bed.	"	Milk, 48 oz. Water, 20 oz.
"	131860	1009	+	+	+1.6 c.c.	Alk. lit. acid phen.	—	0.24	4.46	0	0	0	0.6.67	18.5.1.21	Absence of coma: bright; got out of bed.	Sod. bic., gr. xxx by mouth, 3 doses (90 gr.). 2 eggs.	Milk, 61 oz. Water, 14 oz.
"	141833	1015	+	+	+1.8 c.c.	Alk. lit. acid phen.	1.8	1.86	32.9	0	0	0	0.16.9	14.5.2.3	Absence of coma: quite rational.	"	Milk, 86 oz. Water, 46 oz. 2 eggs.

+ = present; 0 = absent; — = examination not made.

The blood pressure was as follows: Record of maximum and minimum blood pressure for eight months: February and March, 140 to 220 mm.; April, 130 to 210 mm.; May, 120 to 150 mm.; June (period of coma), (Chart III); July, 90 to 150 mm.; August, 150 to 220 mm.; September, 150 to 210 mm.; October and November (period of hemiplegia, prior to death), 160 to 240 mm., 200 constant (Chart IV).

*Report Subsequent to the Coma.* From June 15 to October 24, 1907, the patient showed no evidence of coma. She remained well and active, assisting about the ward; her mental condition was such as had been noted on admission. On October 24, 1907, she again lapsed into a drowsy condition. Acetone, which had been

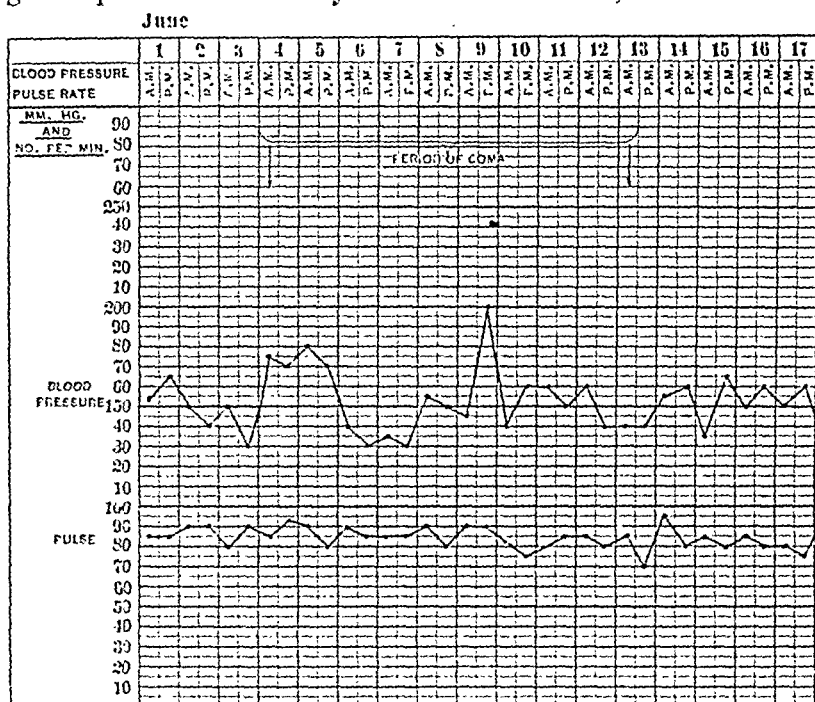


CHART III.—Blood pressure chart during June, period of coma. Compare this chart with that for October and November (Chart IV).

present all along, disappeared from the urine; diacetic acid did not appear. The amount of sugar remained unchanged. Albumin and casts continued to appear as on previous examinations, with some increase in the albumin. Albuminuric retinitis was found. The blood pressure, at this time, will be seen in Chart IV.

On October 25, 1907, definite hemiplegia developed and continued until death occurred, November 20, 1907.

*Autopsy by Dr. Horst Oertel (Report in Brief).* Female body, about forty-eight years of age, 170 cm. long; long, slender frame, fair amount of emaciation; skin, pale, clear; pupils: left, oval, medium size; right, dilated, round; there is a small arcus senilis.

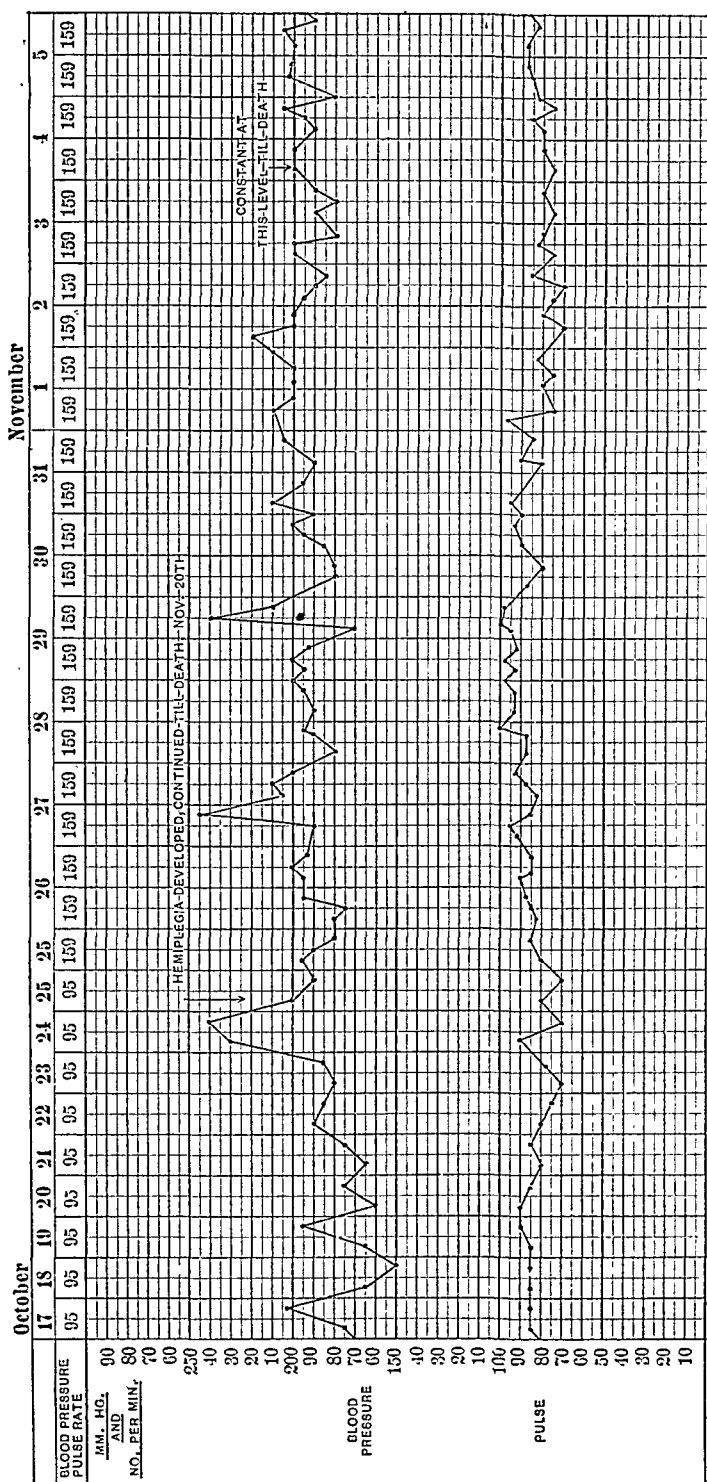


CHART IV.—Blood pressure for October and November; period of hemiplegia, just prior to death. Compare blood-pressure chart of this date with that of June, period of coma (Chart III).



On opening the thorax the left plural cavity is dry and free from adhesions, the right plural cavity is dry and contains a few adhesions over the apex and over the lower lobe in the axilla.

*Heart.* Mitral valves: Posterior valve cusp shrunk; anterior contains large, irregular patches, which are yellowish and have wavy raised edges. The aortic valves are wrinkled and slightly stiffened at their bases. The aortic above contains numerous gamboge-yellow raised patches. The coronaries are small, tortuous, and contain numerous deep, yellow, raised patches. The heart muscle on section is brownish with yellowish mottled areas; the muscle bundles are not distinct; in place there are small white areas.

*Left Lung.* The lung is small, its anterior portions crepitant, its posterior portions bluish, wet, oedematous. There are a few subpleural calcified tubercles, which are surrounded by black anthracotic areas. Upper lobe is crepitant, dry. The pleura at apex is negative. The lower lobe is firmer, wet, and exudes a small amount of frothy serum. The smaller bronchi are slightly reddened. *Right Lung.* The right lung is larger; the upper lobe contains a few puckered pleural thickenings, and on section it is reddish and exudes on pressure frothy serum. Some of the smaller bronchi exude purulent material, and the lobe contains scattered areas which are firm, but from which cut section sinks. The middle lobe is crepitant, emphysematous. The lower lobe is dark red, and contains scattered areas of consolidation, and exudes on pressure frothy serum. The smaller bronchi, especially those of the lower lobe, are bathed in mucopurulent material.

*Spleen.* Negative.

*Left Kidney.* Weight, 185 grams. The kidney is quite large, surrounded by a small amount of perinephric fat; it measures 13 x 7 x 4 cm. The capsule strips with some difficulty, leaving a finely, and in places roughly, granular surface. The lobulations are fairly well marked, and in places contain whitish puckered scars. On section the cortex has an average thickness of 10 mm.; it is yellowish and greasy; the Malpighian bodies not at all distinct. The medulla is reddish in color and the line of demarcation well preserved.

*Right Kidney.* Weight, 180 grams. Same as left.

*Duodenum.* Small, with well-marked rugæ. The papilla is prominent and exudes fluid bile on pressure. Common, cystic, and hepatic ducts free.

*Liver.* Weight, 1500 grams. Its surface is smooth, and contains mottled yellowish areas. On section it has a somewhat greasy surface. The centres of the lobules appear dark red in color. The periphery of the lobules is light yellow.

*Pancreas.* On removing the pancreas, which is rather small, the tail of the organ not reaching the hilum of the spleen, the weight is found to be 100 grams. The organ measures 17 cm. from head to tail. Its middle part is 5 cm. broad and 3 cm. thick. It is surrounded

by very little fat. On cut section, firm; the lobules are irregular in size, pinkish, and separated widely by bands which have a butter-like consistency. The pancreatic duct is apparently surrounded by a large amount of connective tissue. The splenic artery shows moderate atheroma. The pancreatic, common, and hepatic ducts and the gall-bladder are free from stones. Microscopic section shows interstitial and marked interacinar pancreatitis; sclerosis of and diminution in the number of islands; great destruction of pancreatic lobules, bringing islands into clumps.

*Brain.* The brain is small, there being apparently atrophy of both frontal lobes. The vessels at the base of the brain are small, tortuous, and filled with atheromatous plaques. On opening these vessels the lumen gaps and the walls are clotted. On section of the brain a small area of softening is found in the right internal capsule along the motor tract. This area is elongated, being about 5 mm. by 1 cm. It is entirely limited to the motor tract. There is also considerable fluid in both lateral ventricles. The brain substance around this area is very soft. In the right pons is also a small area of softening about 4 mm. in diameter, well localized. Along the motor tracts the spinal cord grossly shows no area of degeneration. The posterior spinal vessels, however, are thickened and tortuous.

**ETIOLOGY OF THE COMA.** 1. *Acidosis or Acid Intoxication.* At the annual meeting of the Association of American Physicians held in 1907 Dr. Folin<sup>2</sup> presented a review of the work done on acid intoxication, and Dr. Joslin,<sup>3</sup> at the same meeting, presented a similar paper on acidosis. From these two papers it appears that, though for the last fifty years much work has been done in Germany and in this country on the high ammonia content and organic acids in diabetes, there is as yet no clear knowledge of either the source of these acids or the part they play in the graver stages of this disease. The chemical features, however, of these conditions are now well established, and from the record here given it can be stated definitely that neither existed in this case. The ammonia remained unusually low throughout the coma, and the diacetic acid was present in small quantity only;  $\beta$ -oxybutyric acid did not appear at any time (Charts I and II). That it would be incorrect to assume the absence of acidosis upon this latter negative finding alone has been pointed out by several authors. Dr. Lusk, with Dr. Mendel, reported a case in which there was absolute intolerance for carbohydrates, and yet for three weeks no  $\beta$ -oxybutyric acid could be detected in the urine, and there was a maximum output of but 0.8 gram. of acetone daily. But this, together with the low ammonia, small total output of urine in twenty-four hours, and prompt alkalizing of the urine with small amounts of alkali (see discussion of treatment below), indicates the absence of acidosis or acid intoxication in this case.

<sup>2</sup> Trans. Assoc. Amer. Phys., 1907, xxii, 256.

<sup>3</sup> Ibid., p. 246.

2. *Uremia.* The urine showed nothing in regard to nephritis, which does not occur in many cases of diabetes. Albumin was present throughout. The great increase in the characteristic casts described by Kulz<sup>4</sup> did not occur at the time of the coma, though casts were at all times present. The most significant finding was the blood pressure (Charts III and IV). The blood pressure ran moderately low during the coma, but in the final attack, which was associated with hemiplegia, the pressure rose and remained uniformly high until death. Albuminuric retinitis showed definitely that nephritis was present. Autopsy showed a chronic diffuse parenchymatous nephritis, which, although indicated by the urine and retinitis, could not, from any clinical manifestation, be held accountable for the coma. Beyond the blood pressure changes and the absence of increase in albumin, we must consider that there were no clinical signs by which uremia as a cause of the coma could be included or excluded.

3. *Brain Softening.* This patient showed from the beginning mental weakness. There was a history of syphilis and evidences of general arteriosclerosis. This evidence was in hand at the time of the onset of the coma. Cases in literature are not lacking<sup>5</sup> to show the frequent association between diabetes and encephalomalacia. Four weeks before death hemiplegia developed, and definite evidence of this condition was found postmortem. At the time of coma, however, we had not these facts, and the stupor was different in no way clinically from graver forms in diabetes. The mental weakness, the incontinence of urine and feces, together with mild diabetes and absence of signs of acid intoxication, were important facts pointing to the central nervous system. The subsequent hemiplegia was very significant. There is no explanation as to how coma, in such brain conditions, is produced.

4. *Disturbed Protein Metabolism.* Although nitrogen partition was made in this case, it seems inadvisable to attempt conclusions from one case. This portion of the record, therefore, is omitted.

**ALKALINE TREATMENT.** This, while of no value therapeutically in the present case, proved to be so diagnostically. It will be remembered that treatment, as recommended by Stadelmann and followed by Naunyn and Magnus Levy, required 100 grams of bicarbonate of sodium a day. As high as 80 grams have been injected intravenously, the reaction of the urine being the guide to the quantity to be administered. In the case here reported 150 grams by the mouth in three days was sufficient to alkalize the urine. This was in itself evidence of either the absence of acid formation or, if present, in quantity insufficient to account for such grave clinical manifestations as appeared.

<sup>4</sup> Domansky and Reimann, *Zschr. f. Heilk.*, 1901, and Herrick, *AMER. JOURN. MED. SCI.*, 1900, vol. cxx.

<sup>5</sup> Frerich, Ogle, Dreyfus, etc., cited by Naunyn.

**CONCLUSIONS.** From the foregoing evidences the case seems to have been one of syphilitic arteriosclerosis (history of syphilis, presence of arterial thickening, arcus senilis, and aortic cardiac sclerosis), with involvement of the pancreas, kidney, and brain. The sclerotic changes in the pancreas (interacinar pancreatitis) led to the diabetes, those in the kidney (chronic parenchymatous nephritis) to the chronic nephritis (albuminuria, casts, and albuminuric retinitis), and those in the brain to the softening with hemiplegia, to the feeble mentality, and possibly to the coma.

At the bedside, when the coma appeared, the syphilitic history, the arteriosclerosis, the enfeebled mentality, the mild grade of diabetes, the absence of any increase in the diacetic acid, the non-appearance of  $\beta$ -oxybutyric acid, the low ammonia, the small quantity of alkali required to alkalize the urine, the absence of any increase in total quantity of urine in twenty-four hours, seemed to be clinical features differentiating this coma from the graver forms. The subsequent hemiplegia was very significant. The low blood pressure and absence of any increase in albumin and casts were suggestive, but not positive signs by which uremia could be excluded. The urinary findings and the small amount of alkali required to alkalize the urine seem in themselves important guides in diagnosis and safeguards against false conclusions with regard to the part played by the alkaline treatment.

The only coma in diabetes clinically defined is the dyspnœic type, and the only coma chemically defined is that due to acidosis and acid intoxication. The diagnosis of these conditions, as a rule, offers no great difficulty. It is the atypical group or that due to complications which occurs more frequently and which presents the real diagnostic and prognostic problem to the clinician. The nephritis and brain condition are most important in the consideration of the coma, but in the absence of any clear knowledge of how coma is produced in uremia or brain softening, the mere statement of their presence is not sufficient to exclude other factors resulting from disturbed metabolism (proteid for example) which subsequent investigation may disclose.

The discussion of the case with nine months' clinical record, and, finally, the postmortem findings before one is very different from the problem offered the clinician at the bedside at the onset of the coma. At that time it was impossible to say that fatal coma was not developing. I believe two important findings at that time justified one in assuming that the coma was of mild type, namely, the character of the urine and the amount of alkali required to neutralize the urine. In forty-eight hours from the onset of the coma these features manifested themselves. While no explanation of the coma appears in the record, these clinical findings may prove to be features differentiating the comparatively common non-fatal coma in diabetes (due possibly to complication or some yet

unexplained metabolic disturbance) from the rapidly fatal coma in this disease.

The laboratory examinations were done in the Strecker Laboratory under Dr. Oertel and in the Cornell Clinical Laboratory under Dr. Hastings. I wish to thank Drs. Woodruff and Groeschel, house physicians, for their interest and care in preparing the records.

Dr. Joslin kindly reviewed the records with regard to the question of acidosis, or acid intoxication, and his opinion is expressed in the following letter:

"In my opinion the case . . . illustrates coma simulating the coma of acid intoxication, and yet certainly has absolutely no connection with that form. It is essential for physicians to remember this possibility, and not to treat all cases of coma in diabetes as if due to acid intoxication. The case is further valuable because so often in the past cases of coma in diabetes have been said to occur without proving the acidosis. This case was carefully studied, acidosis eliminated, and coma proved to be of another type.

"The case was evidently mild diabetes, because the carbohydrate balance was pretty certainly, from the records given, positive rather than negative. For example, the greatest quantity of sugar was 84 grams on February 27, and yet evidently considerable milk was used at that time, and the diet probably contained more than this amount of carbohydrates. Further, the case was evidently mild, because there was no diacetic acid in the urine during February, March, April, and only a very small quantity in June. Diacetic acid constitutes only about 10 per cent. of the total acidosis, and acetone constitutes only about 10 per cent. of the combined acetone and diacetic acid. Consequently we are absolutely certain that the acidosis was insignificant.

"For the above reasons it is not necessary to know more details of the urine during the coma, because the analyses before and after settle the severity of the case. There are a few additional factors which help to exclude the acidosis: First, the fact that the urine became alkaline on June 8, during the coma, while the patient was taking an insignificant quantity of alkali, *c. g.*, 2 grams hourly. Second, the total quantity of urine at no time exceeded 2000 c.c. No case of diabetic acidosis, to my knowledge, has been reported without Nature making an effort, by the passage of large quantities of liquid, to wash out acids from the body. Third, the increase in the percentage of ammonia was very slight, and the total quantity far too low to enable one to claim acidosis."

## THE PATHOLOGICAL CHANGES IN THE THYROID GLAND, AS RELATED TO THE VARYING SYMPTOMS IN GRAVES' DISEASE.

BASED ON THE PATHOLOGICAL FINDINGS IN 294 CASES.<sup>1</sup>

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THE material for the following study was obtained from operations and autopsies on cases of Graves' disease (hyperthyroidism, exophthalmic goitre) in St. Mary's Hospital, Rochester, Minnesota, from March 3, 1898 to May 10, 1908. The material in 2 of the cases was obtained at autopsy on patients dying of hyperthyroidism without having been operated upon. These autopsies were made within two hours of the death of the patient. All of the other material consisted of glands removed by Dr. C. H. Mayo.<sup>2</sup> Thirty-five of the cases were operated upon prior to the reorganization of the laboratory, January 1, 1905. When this study was begun there was not sufficient data at hand from which to make a complete pathological analysis of these 35 cases. No report, however, has been previously made on their pathology, and I desire, therefore, to place them now on record as fully as the data will permit, although they will not be considered in estimating the percentages of the pathological groups of the cases studied in full detail.

This series consists of: (A) 11 cases in young females whose symptoms had existed without remission or abatement from two months to two years, and who at the time of examination presented all the classic symptoms of Graves' disease in a severe form. The pathological diagnosis on all of these cases was noted at the time as "typical exophthalmic goitre." (B) 9 cases in females whose symptoms had existed from one to eleven years, but all of whom were better at the time of examination than they had been at some previous period. In all of these cases the pathological report is either "typical exophthalmic goitre," or "exophthalmic goitre with colloid." (C) 14 cases in females whose symptoms had been present from three to thirty years, or from three months to one year following a previous long period of non-symptomatic goitre, and at no time had shown symptoms of more than moderate severity. The pathological report on these cases is "colloid adenoma."

<sup>1</sup> To avoid future confusion Professor James Ewing authorizes me to state that the 40 cases reported by him in the New York Medical Journal, 1906, lxxxiv, 1061, 1114, were exclusive of the cases in this series, although he had also studied sections from a number of my cases.

<sup>2</sup> This series does not include 13 cases operated on by Dr. C. H. Mayo in other hospitals, since no material from these cases was obtained in our laboratory.

With the reorganization of the laboratory, January 1, 1905, with an increased staff and increased facilities, it became possible to take care of the pathological material to better advantage. Since that time all specimens are brought immediately from the operating room to the laboratory, where they are examined fresh and then placed in fixatives, usually within ten minutes after they are removed from the patients. Blocks of tissue from each are fixed in 10 per cent. formalin, absolute alcohol, Zenker's fluid, and Flemming's chromosmic mixture. The remainder of the specimen is then photographed and preserved by Kaiserling's method.<sup>3</sup> Microscopic preparations are made of the fresh material frozen and stained with polychrome methylene-blue, by the author's method,<sup>4</sup> and also of the formalin-fixed material, frozen and stained with hematoxylin-eosin. From the examination of these two preparations the initial histological record is made on the history sheets. When the final study was begun, material from the various fixatives was sectioned by the paraffin method and stained with hematoxylin-eosin, Heidenhain's iron hematoxylin, and Mallory's methylene-blue-eosin. The histology of each case was then carefully reviewed from all the preparations at hand, and notes made according to a formula compiled from the reports of previous observers.<sup>5</sup> As may be supposed the detailed data from these studies are much too voluminous to report in any one paper, and it is only that portion of it which seems to be related to the clinical histories to which I wish now to call attention.

While this review was in progress every care was taken to exclude all knowledge of the clinical histories of the cases in order that there might be no clinical bias entering into the pathological estimate. As the work proceeded it was found that certain pathological pictures were frequently repeating themselves. When the examinations were completed these pictures were found to represent cases constituting four large groups, and there was little trouble in arranging the remainder of the cases so as to form connecting groups between the large and more striking ones. The following cases presented from the pathological standpoint will illustrate these groups with sufficient accuracy for the succeeding clinical comparisons:

**PATHOLOGICAL GROUP A.** Case No. 24,550 (Fig. 1).—This specimen is a gland, the removed portion of which weighs 30 grams fresh. Grossly it is hard and nodular. The cut surface is particularly dry and granular throughout. There is considerable increased vascu-

<sup>3</sup> Some of the gross specimens have been sent to other laboratories. This material was not on hand at the time of the present review. In these cases the detailed review of the gross anatomy was made from written descriptions and photographs of the fresh specimens.

<sup>4</sup> Jour. Amer. Med. Assoc., December 2, 1905.

<sup>5</sup> It is proper to state that as a preliminary study about 300 simple goitres were examined and, as occasion arose during the progress of the work on the Graves' goitres, the former were again reviewed and compared with the latter.

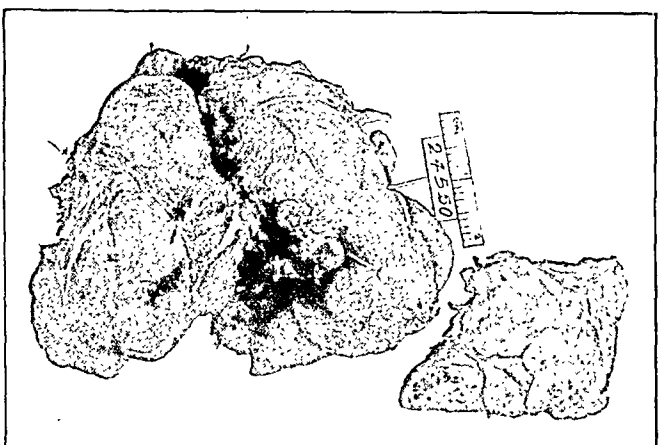


FIG. 1.—Photograph of the thyroid gland.  $\times \frac{1}{10}$ .

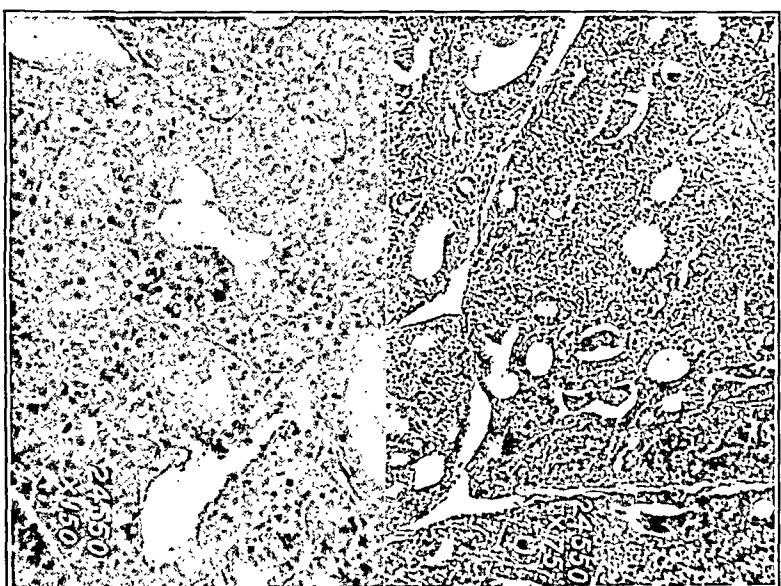


FIG. 2.—Photomicrographs.



FIG. 3.—Portrait before operation.







FIG. 4.—Photograph of the thyroid gland.  
X  $\frac{3}{8}$ .

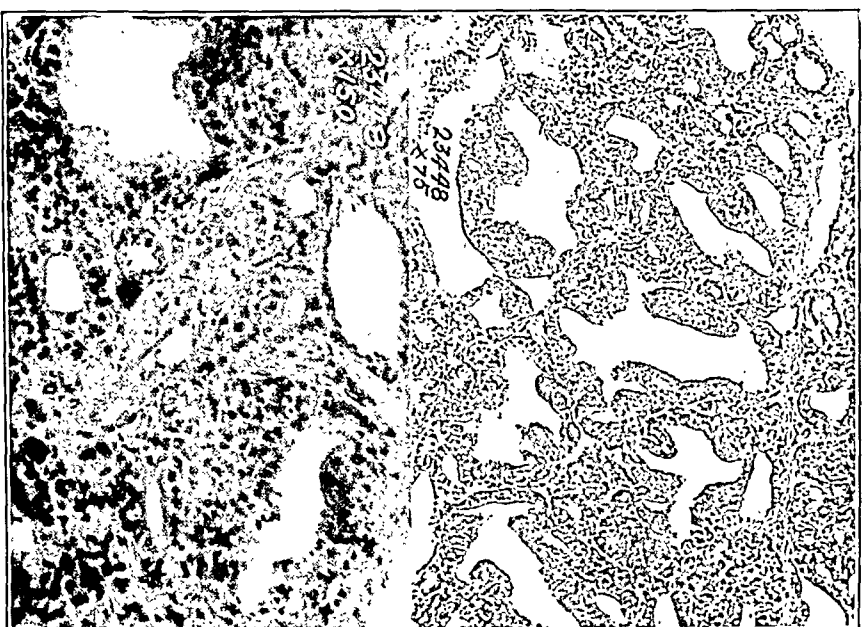


FIG. 5.—Photomicrographs.



FIG. 6.—Portrait before operation.



GROUP B.

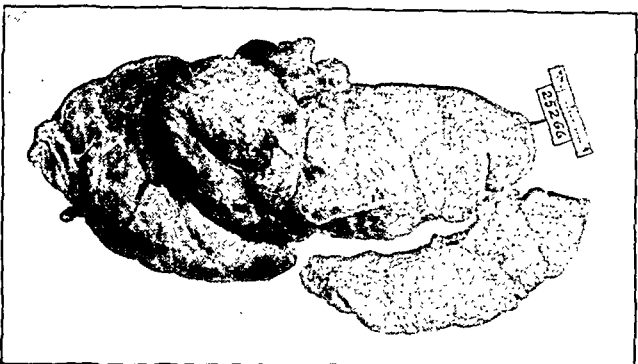


FIG. 7.—Photograph of the thyroid gland.  $\times \frac{1}{2}$ .

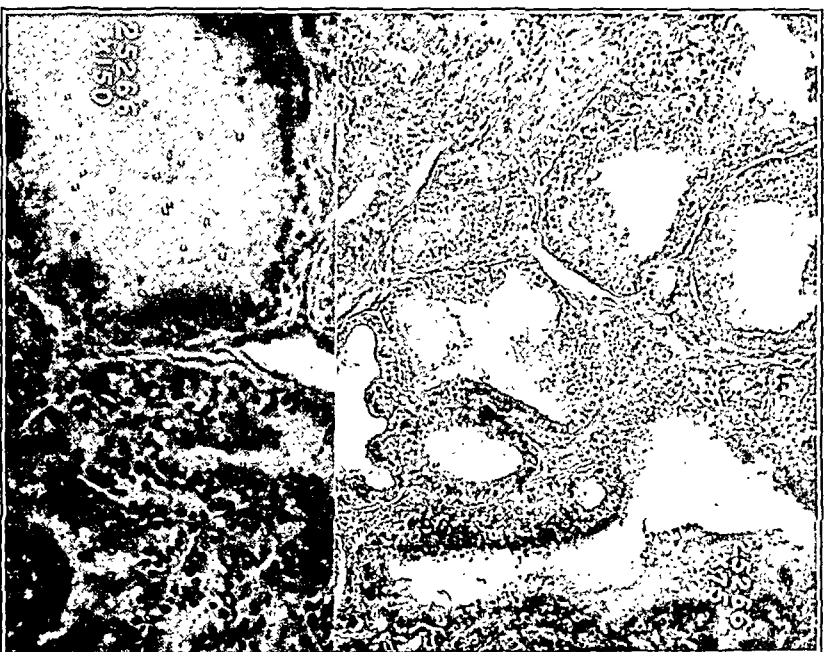


FIG. 8.—Photomicrographs.



FIG. 9.—Portrait before operation.



larity, the veins being swollen and thin walled. Microscopically (Fig. 2) the stroma bands are found considerably thickened and extensively infiltrated with leukocytes. The alveoli are from 0.06 to 0.2 mm. in diameter. There are very few papillary projections into the alveoli. The parenchyma cells are increased in number in certain alveoli, both in the single layers and by reduplication of the layers. The parenchyma cells are columnar, about 10 microns in diameter, have swollen nuclei, granular protoplasm, and show in many areas mitotic figures. There is apparently no exfoliation of the parenchyma cells. The secretion is small in amount and non-eosin staining. From the pathological standpoint the symptoms, if any, in such a case, should be those of very early, mild hyperthyroidism. The clinical history shows that the gland is from a female (Fig. 3), aged twenty years, who has had a slight symptomless enlargement of the thyroid for one year, and moderate Graves' symptoms for the last two months, that is, tachycardia, fine tremor, sweating, etc.

This case is representative of a very small group (Group A) of operated cases, there being but 3 patients (10 per cent.) in our entire list, although a number of other patients, of parallel clinical characteristics who have presented themselves for examination, would probably have yielded glands of similar pathology had they been operated upon.

The characteristics of this group may be stated as follows: 1. Small intra-alveolar parenchyma increase. Shown by: (a) Size of the gland; (b) increased number of cells in a single layer; (c) reduplication of layers. 2. Small amount of thin secretion. Shown by: (a) Dryness of the fresh section; (b) small amount of secretion in stained sections. This is non-eosin staining.

**PATHOLOGICAL GROUP B.** Case No. 23,448 (Fig. 4).—This is a 53-gram gland, hard and nodular externally, granular, with a slightly glairy cut surface. Histologically (Fig. 5) the sections show increased alveolar parenchyma, papillæ formation, and a large amount of non-staining secretion. Clinically (Fig. 6) the patient is a female, aged thirty-six years, who, after three years progressive Graves' disease, now shows severe symptoms, that is, nervousness, tachycardia, tremor, some diarrhoea and vomiting, and exophthalmos.

Case No. 25,266 (Fig. 7).—This is a 60-gram gland of the same character grossly as the preceding. Histologically (Fig. 8) there is a large amount of intra-alveolar parenchyma increase, papillæ formation, and a large amount of thin secretion. Clinically (Fig. 9) the patient is a woman, aged twenty-eight years, with a history of two years of Graves' disease, and at present severe symptoms, that is, tachycardia, nervousness, tremor, profuse sweating, some diarrhoea and vomiting, and exophthalmos.

Case No. 18,339 (Fig. 10).—This gland weighs 60 grams fresh, is hard and rigid, with a nodular outer surface. The veins are swollen, varicosed, and thin-walled. Histologically (Fig. 11) the section shows a picture almost parallel with that of the previous case, except that the alveoli here are larger and the papillary projections in them are numerous, while there is a large amount of thin, non-eosin staining secretion. Pathologically this case should be in the acute stage and severe in type. Clinically (Fig. 12) the patient is found to be a female, aged nineteen years, with Graves' symptoms for one year, and now of severe type, that is, nervousness, tremor, weakness, exophthalmos, and pulse 150.

Case No. 23,095 (Fig. 13). This is a 95-gram gland, hard and nodular, and dry and granular on its fresh-cut surface. The large, irregular alveoli (Fig. 14) are lined with swollen parenchyma cells which have not begun to exfoliate. The secretion is fairly large in amount, thin, and feebly staining. A severe first period is indicated pathologically. Clinically (Fig. 15) the patient is a woman, aged twenty-five years, who, for two months, has had a progressive chain of symptoms of hyperthyroidism, that is, nervousness, tremor, palpitation, tachycardia, exophthalmos, diarrhœa, and vomiting, and now would be considered a case of very severe grade.

Case No. 23,099 (Fig. 16).—This is a 120-gram gland, hard and nodular, with a granular, glairy, cut surface, and swollen tortuous veins. Histologically (Fig. 17) there are large alveoli with great intra-alveolar parenchyma increase, papillæ formation, and a large amount of thin, non-staining secretion. Clinically (Fig. 18) the patient is a female, aged thirty-six years, who has had progressive symptoms of Graves' disease for three years. They are now of a very severe type, that is, tremor, palpitation, tachycardia, diarrhœa and vomiting; exophthalmos for one year and a half.

Case No. 21,328 (Fig. 19).—This is a very large gland, weighing 223 grams fresh. It feels hard, has a nodular outer surface, and a glairy, cut surface. The veins are swollen and tortuous; the walls of the large vessels are thin, and there are many small hemorrhages with marked hyperemia throughout the gland. The alveoli, papillary projections, parenchyma cells, etc., are parallel to those in the previous cases as will be seen (Fig. 20). Pathologically this should be a severe acute case. Clinically (Fig. 21) the patient is a male, aged thirty-seven years, who has presented a set of symptoms of Graves' disease of gradually increasing severity for six years, and who is now in an extremely critical condition. There has been no remission of symptoms at any time in this case. His history shows he has lost forty pounds in weight in the last six months previous to operation.

These 6 cases illustrate quite fully pathological Group B. This is the largest group in the series, containing 117 cases, or about 45 per cent. — Clinically all of these cases, except 8, are to be found

GROUP B.

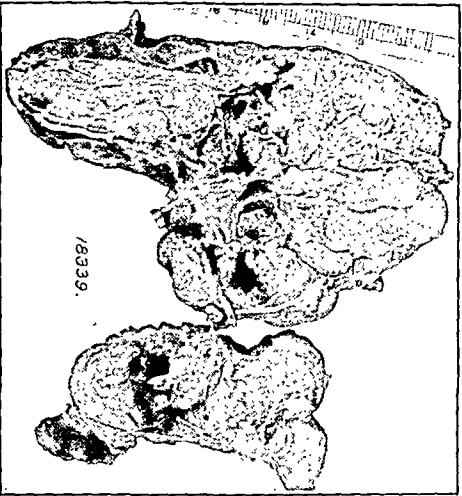


FIG. 10.—Photograph of the thyroid gland.  $\times \frac{3}{16}$ .

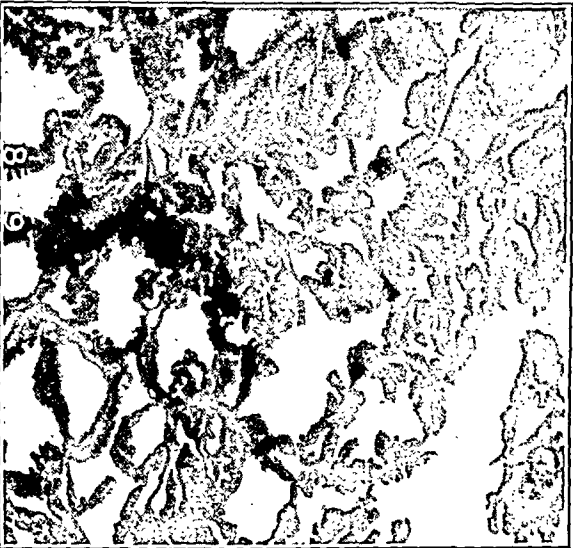


FIG. 11.—Photomicrograph.



FIG. 12.—Portrait before operation.





GROUP B.

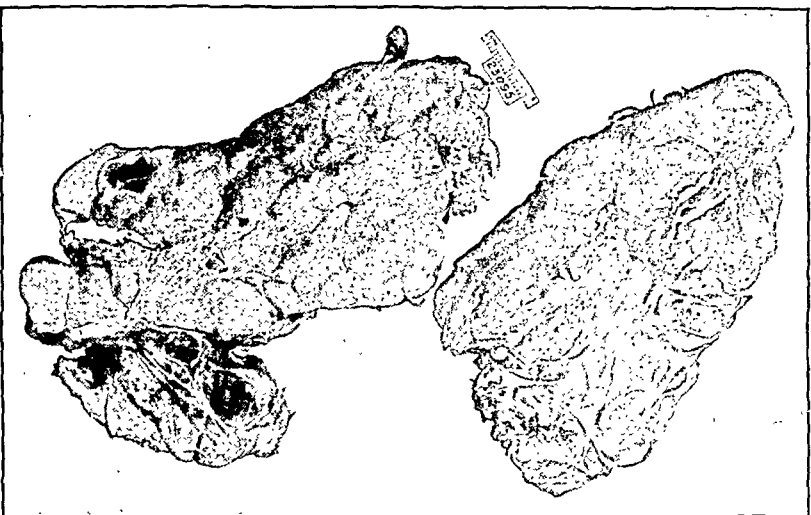


FIG. 13.—Photograph of the thyroid gland.  $\times \frac{1}{2}$ .

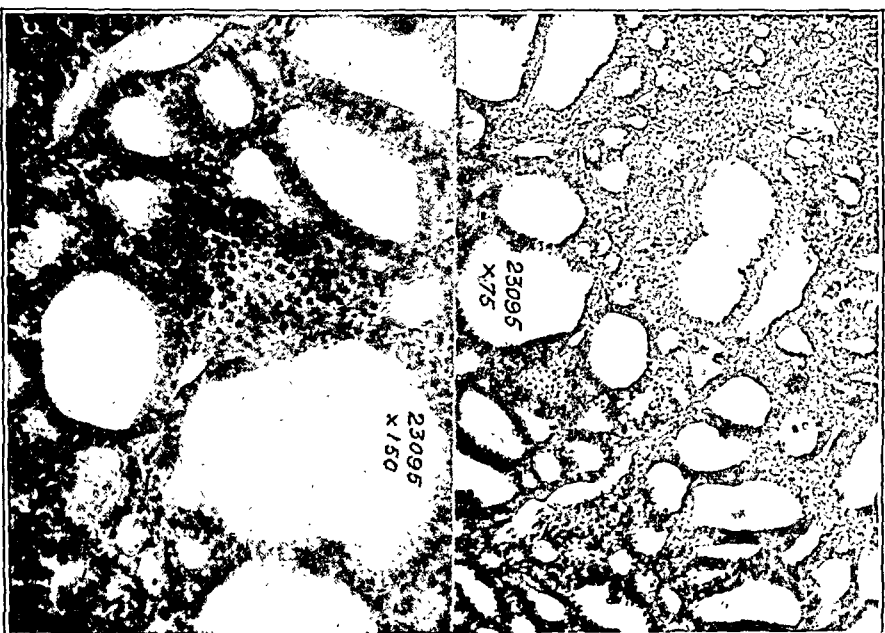


FIG. 14.—Photomicrographs.



FIG. 15.—Portrait before operation.



GROUP B.

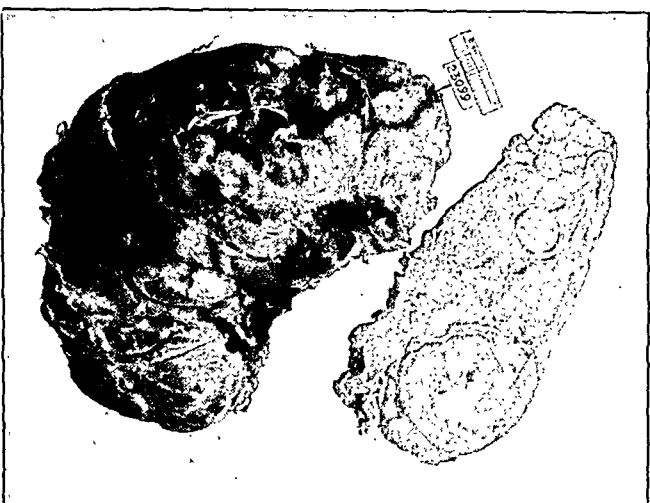


FIG. 16.—Photograph of the thyroid gland.  $\times \frac{1}{2}$ .

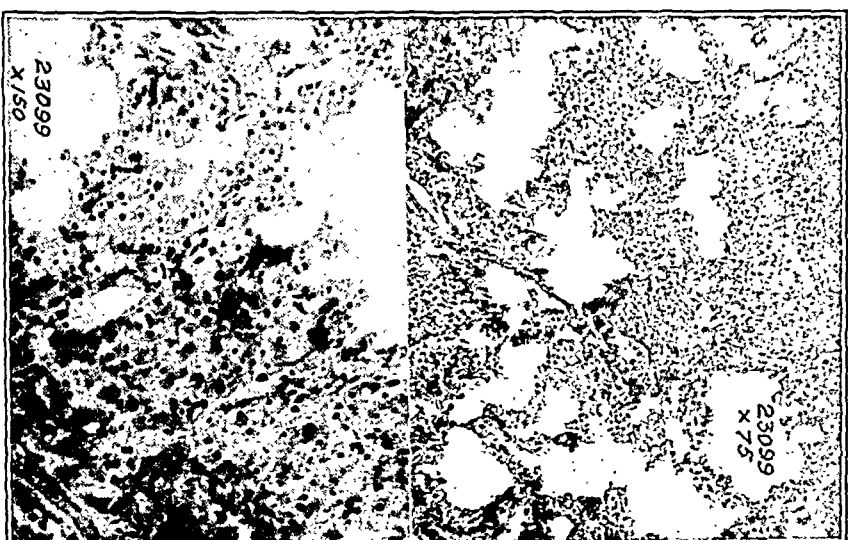


FIG. 17.—Photomicrographs.



FIG. 18.—Portrait before operation.



GROUP B.

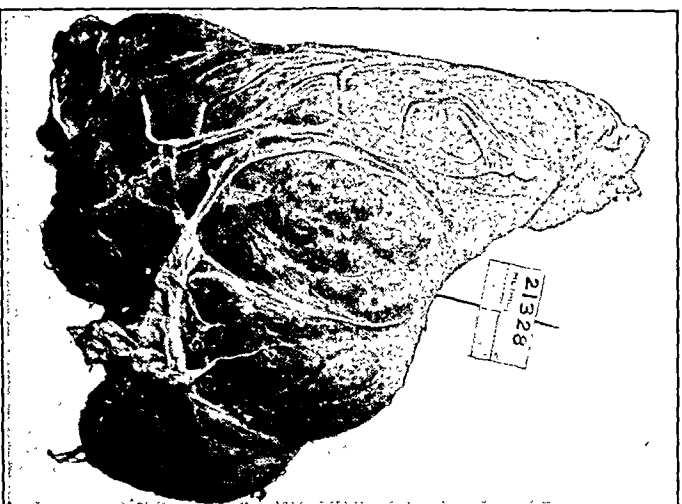


FIG. 19.—Photograph of the thyroid gland.  $\times \frac{3}{2}$ .

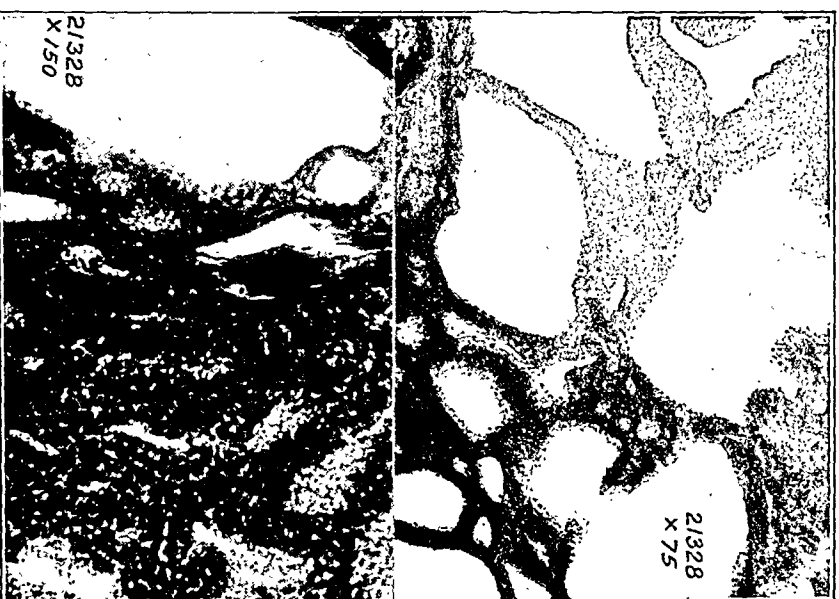


FIG. 20.—Photomicrographs.



FIG. 21.—Portrait before operation.



GROUP C.

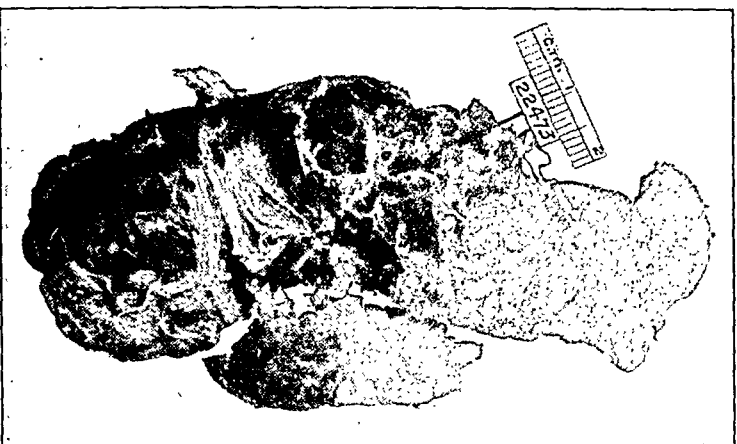


FIG. 22.—Photograph of the thyroid gland.  $\times \frac{1}{6}$ .

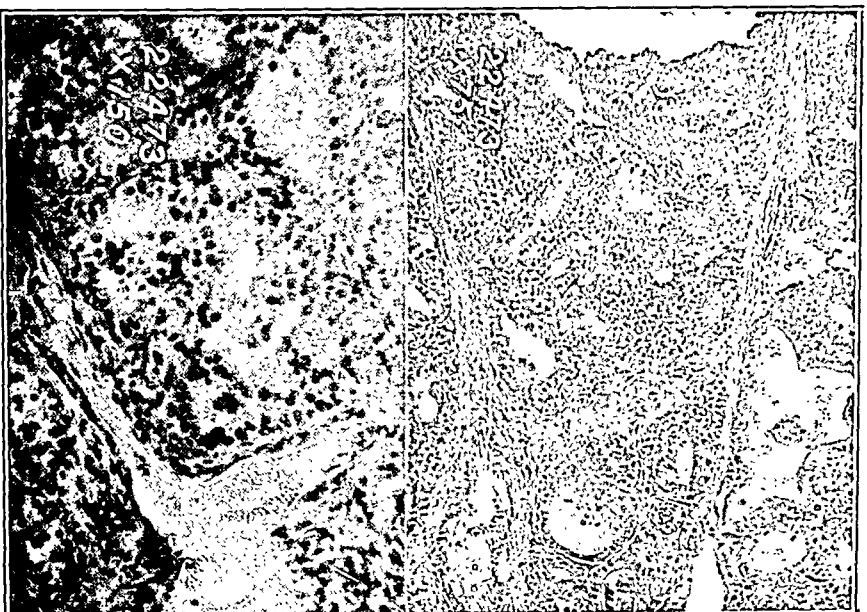


FIG. 23.—Photomicrographs.



FIG. 24.—Portrait before operation.





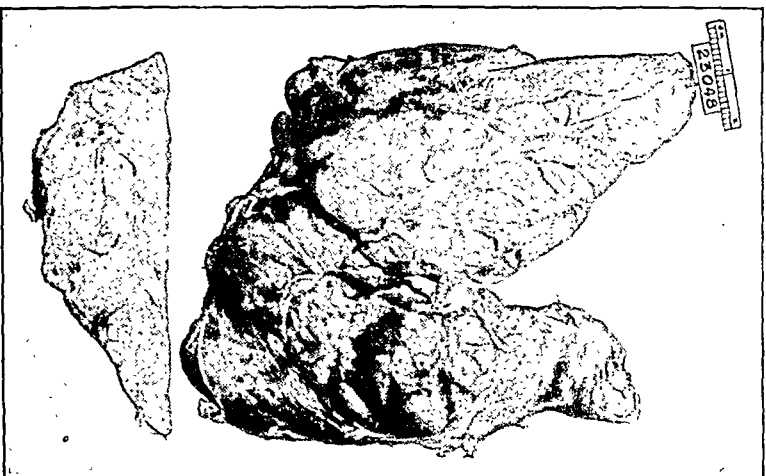


Fig. 25.—Photograph of the thyroid gland.  $\times \frac{2}{3}$ .



Fig. 26.—Photomicrographs.



Fig. 27.—Portrait before operation.



in the first, that is, acute stage of the disease, and all of them, of two, three, or four, degrees of severity; 7 of the remaining 8 cases had shown some remission of symptoms and they are counted in our series of partial disagreements.

The characteristics of this group may be stated as follows: 1. Large intra-alveolar parenchyma increase. Shown by: (a) Size of the gland; (b) increased number of cells in a single layer; (c) reduplication of layers; (d) infolding of alveolar walls; (e) papillæ formation. 2. Large amount of thin secretion. Shown by: (a) "Glair" of fresh section; (b) large amount of secretion which is non-eosin staining in stained sections.

**PATHOLOGICAL GROUP C.** Case No. 22,473 (Fig. 22).—This is a 35-gram gland whose granular, glairy, cut surface presents some alternating areas of gelatinous appearance. Histologically (Fig. 23) the large alveoli contain numerous papillary projections, but the columnar parenchyma cells are exfoliating in many areas. There is a large amount of secretion, much of which is non-staining, but some of which is stainable. Pathologically this case should show some remission over its previous symptoms. Clinically (Fig. 24) the patient is a woman, aged twenty-nine years, who for three years has shown symptoms of Graves' disease, which, although now of a severe type, are less severe than they have been previously.

Case No. 23,048 (Fig. 25).—This is a 45-gram gland, hard, nodular, with much of the cut surface granular, glairy, but in some areas gelatinous. Histologically (Fig. 26) there are large alveoli, great intra-alveolar parenchyma increase, papillæ formation, and a large amount of secretion, some of which is stainable and some unstainable. There is also considerable exfoliation of parenchyma and marked cytolysis in some areas. Clinically (Fig. 27) the patient is a female; aged thirty-seven years, who has had symptoms of Graves' disease for sixteen years. Although her present symptoms are now those of very severe hyperthyroidism they have been worse, and there have been numerous remissions during the period of her illness.

These cases illustrate pathological Group C. Clinically this group contains 54 of our cases, or about 21 per cent. These are almost all second-stage cases; that is, those showing more or less remission of previously severe symptoms, although even now they are of severe or very severe type.

The characteristics of this group may be stated as follows: 1. Large intra-alveolar parenchyma increase. Shown by: (a) Size of the gland; (b) increased number of cells in single layer; (c) reduplication of layers; (d) infolding of alveolar walls; (e) papillæ formation. 2. Large amount of thin secretion. Shown by: (a) "Glair" of fresh section; (b) large amount of secretion, most of which is non-eosin staining, in stained sections. 3. Beginning

degeneration. Shown by: (a) Denser staining of some of the secretion; (b) beginning exfoliation of the parenchyma.

**PATHOLOGICAL Group D.** Case No. 21,374 (Fig. 28).—This is a 200-gram goitre, hard and nodular externally, and with gelatinous cut surface. There is no markedly increased vascularity, while the stroma has materially increased. Histologically (Fig. 29) the alveoli are very large (0.6 to 1 mm.). There is almost complete exfoliation of the parenchyma cells, but the original character of the gland is definitely shown by well-preserved remains of papillæ in some of the alveoli. The secretion is very large in amount and well staining, being of the so-called "colloid" variety. If this represents a form of degeneration, the case should be one improved over its previous history. Clinically (Fig. 30) the patient is a woman, aged forty-four years, whose first Graves' symptoms developed about eight years ago. Although the condition of the heart makes the case still a severe one, yet the symptoms of hyperthyroidism are much reduced over what they were three years ago.

Case No. 21,756 (Fig. 31). This is a gland weighing 81 grams, whose cut surface is gelatinous throughout. Histologically (Fig. 32) the large alveoli contain well-staining secretion filled with the remains of exfoliated cells, and showing, in only a few instances, papillary projections sufficiently well preserved for identification. Clinically (Fig. 33) the patient is a female, aged fifty-seven years, who, for two years, until three years ago, had marked Graves' symptoms. Her present symptoms although mild are sufficiently well marked for diagnosis, although not enough to warrant operative interference, were it not for the pressure symptoms caused by the large gland. This is a case of self-cured Graves' disease, with the exception of the rapid heart and choking sensations.

These cases represent pathological Group D. There are 34 cases in this group, or 12 per cent. Clinically all of them are in the second or third clinical stages; that is, they show marked total improvement, or, at least, some cessation of the symptoms of acute hyperthyroidism. Many of them are still of two to four degrees severity.

The characteristics of this group may be stated as follows: 1. Old intra-alveolar parenchyma increase. Shown by: (a) Size of the gland; (b) remains of infolding; (c) remains of papillæ. 2. Large amount of thick secretion. Shown by: (a) Gelatinous appearance of fresh section; (b) large amount of secretion, most of which is eosin staining, in stained sections. 3. Advanced degeneration. Shown by: (a) dense staining of most of the secretion; (b) more or less complete exfoliation of the parenchyma.

**PATHOLOGICAL GROUP E.** Case No. 21,964 (Fig. 34).—This is an 88-gram gland, hard and nodular externally, and showing small

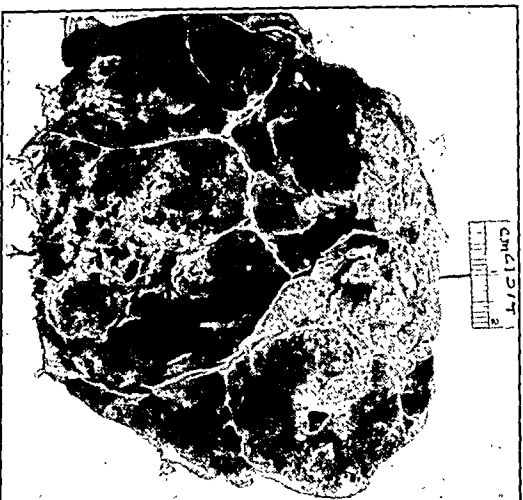


Fig. 28.—Photograph of the thyroid gland.  $\times \frac{2}{5}$ .

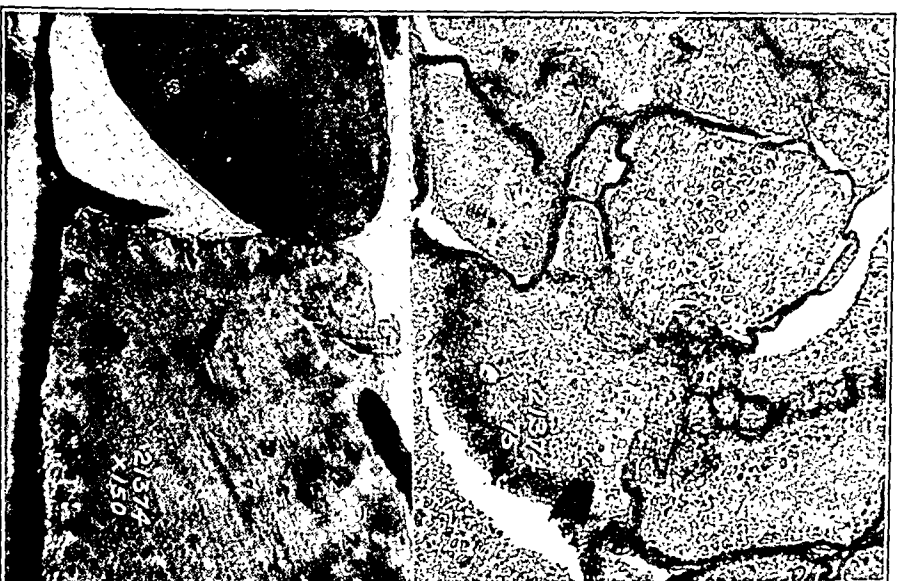


Fig. 29.—Photomicrograph.



Fig. 30.—Portrait before operation.



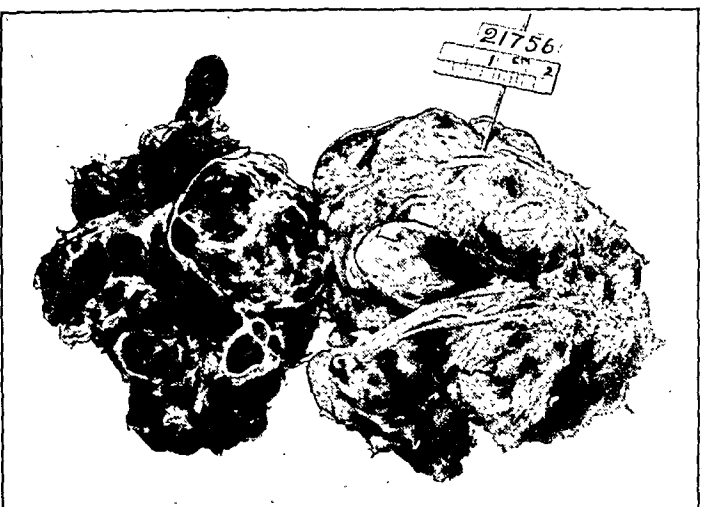


FIG. 31.—Photograph of the thyroid gland.  $\times \frac{1}{2}$ .

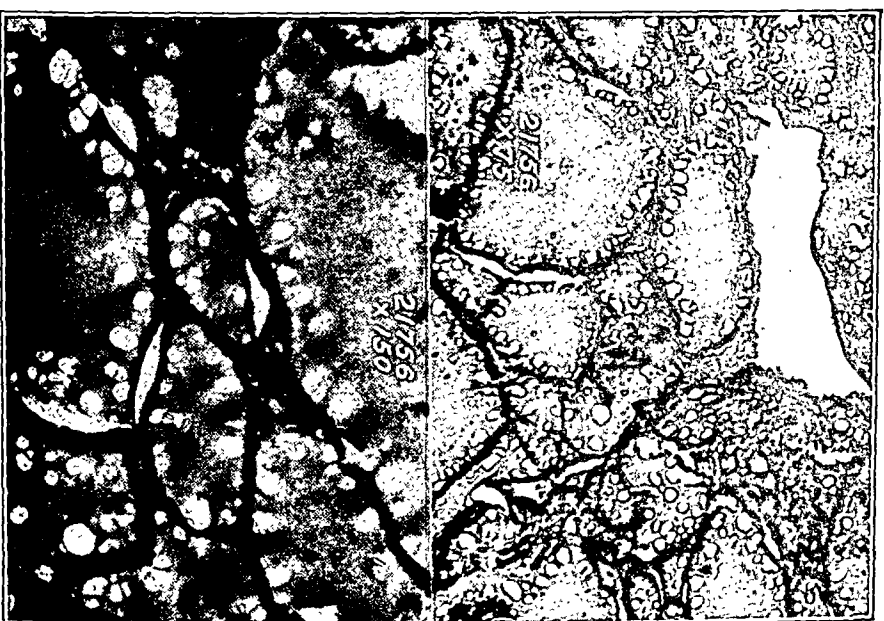


FIG. 32.—Photomicrograph.



FIG. 33.—Portrait before operation.







FIG. 34.—Photograph of the thyroid gland.  $\times \frac{1}{2}$ .

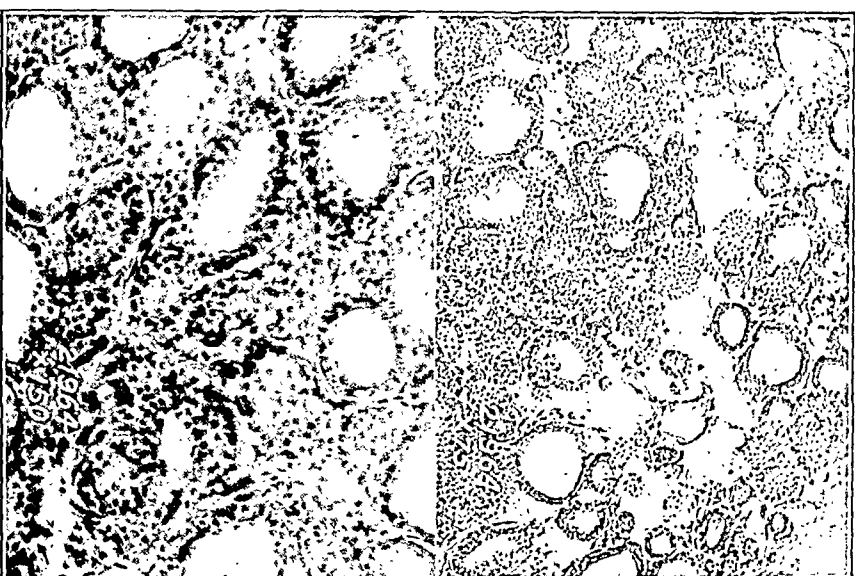


FIG. 35.—Photomicrographs.



FIG. 36.—Portrait before operation.



GROUP I.

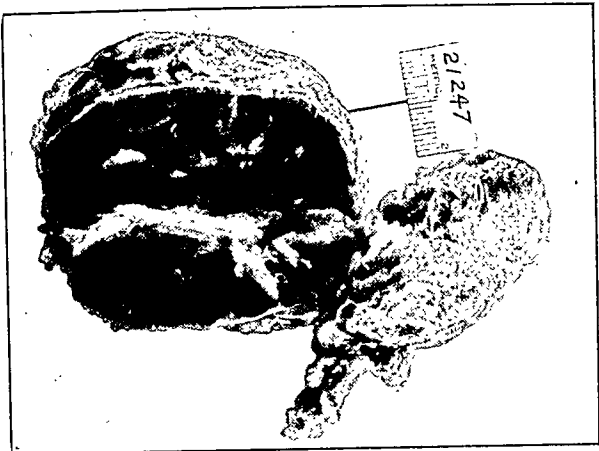


FIG. 37.—Photograph of the thyroid gland.  $\times \frac{3}{16}$ .

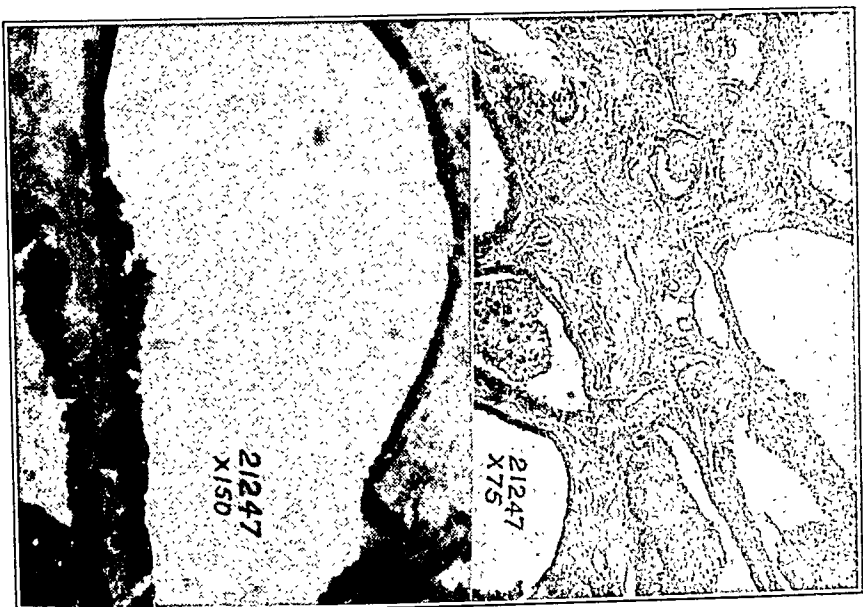


FIG. 38.—Photomicrographs.



FIG. 39.—Portrait before operation.



GROUP G.

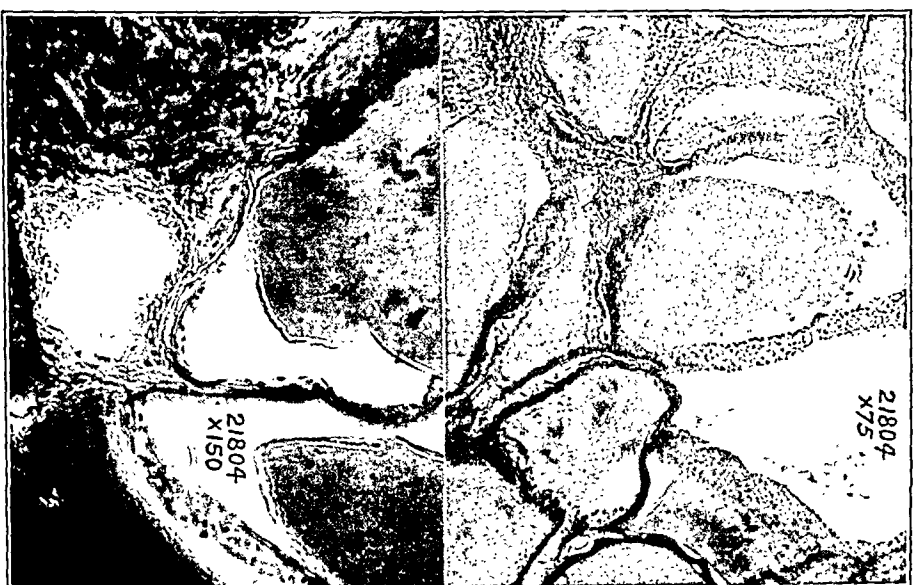


FIG. 40.—Photograph of the thyroid gland.  $\times 36$ .



FIG. 42.—Portrait before operation.

siderable exfoliation of its parenchyma. Clinically (Fig. 42) the patient is a female, aged twenty years, who has had mild Graves' symptoms for a year and one-half; that is, goitre, nervousness; pulse has been 180, is now 130; menstruation has not been disturbed. One year after her operation her return history shows her to be well.

This case represents pathological Group G of which there are 11 cases, or 4 per cent., in our series. All of these are mild continuous of but moderate severity (Grade 2).

The characteristics of this group may be stated as follows: 1. Large multi-alveolar parenchyma increase. Shown by: (a) Size of the gland; (b) recently formed alveoli. 2. Large amount of secretion. Shown by: (a) Large amount of secretion, most of which is non-eosin staining, in stained sections. 3. Beginning degeneration. Shown by: (a) Denser staining of some of the secretion; (b) beginning exfoliation of the parenchyma.

**PATHOLOGICAL GROUP H.** Case No. 23,724 (Fig. 43). This is a 55-gram gland whose cut surface is gelatinous and filled with cysts. Histologically (Fig. 44) the alveoli are large (from 0.2 to 0.5 mm. in diameter) and of adenomatous type. There is marked exfoliation in most areas. The secretion is large in amount and well stained. Pathologically this is an old adenomatous proliferation producing mild, exophthalmic symptoms. Clinically (Fig. 45) the case is a female, aged fifty-two years, who had had an old goitre for seventeen years. Within the last three years she has developed moderately severe symptoms of Graves' disease which have been at a stand-still for the past year.

This group represents pathological Group H. It contains 24 cases, or about 10 per cent. of the series. Clinically they are all mild, continuous or first-stage cases, and none are of more than moderate severity (Grade 2).

The characteristics of this group may be stated as follows: 1. Old multi-alveolar parenchyma increase. Shown by: (a) Size of the gland; (b) sometimes scattered groups of recently formed alveoli. 2. Large amount of thick secretion. Shown by: (a) Gelatinous appearance of fresh section; (b) large amount of secretion, most of which is eosin staining, in stained sections. 3. Advanced degeneration. Shown by: (a) Dense staining of most of the secretion; (b) more or less complete exfoliation of the parenchyma.

On the basis of the above pathological grouping, which was made originally without reference to clinical conditions and without knowledge of the clinical facts in any of the cases, I ventured a conjecture as to the probable clinical history in each case. Aside from the pathological data this conjecture was based on the working hypothesis that the severity of the symptoms in Graves' disease is probably directly proportional to the amount of thyroid secretion

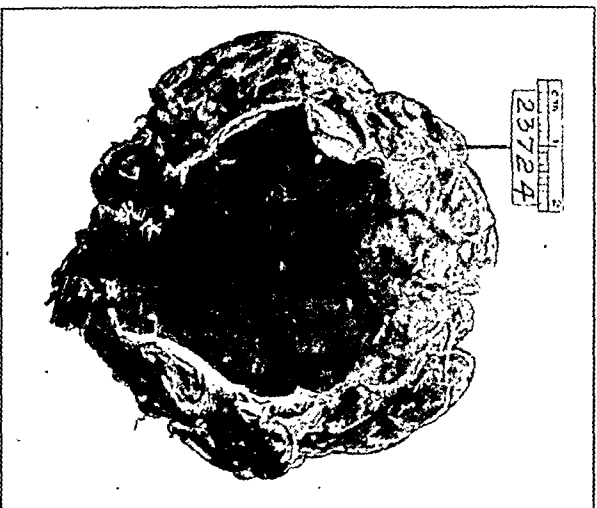


FIG. 43.—Photograph of the thyroid gland.  $\times \frac{2}{3}$ .

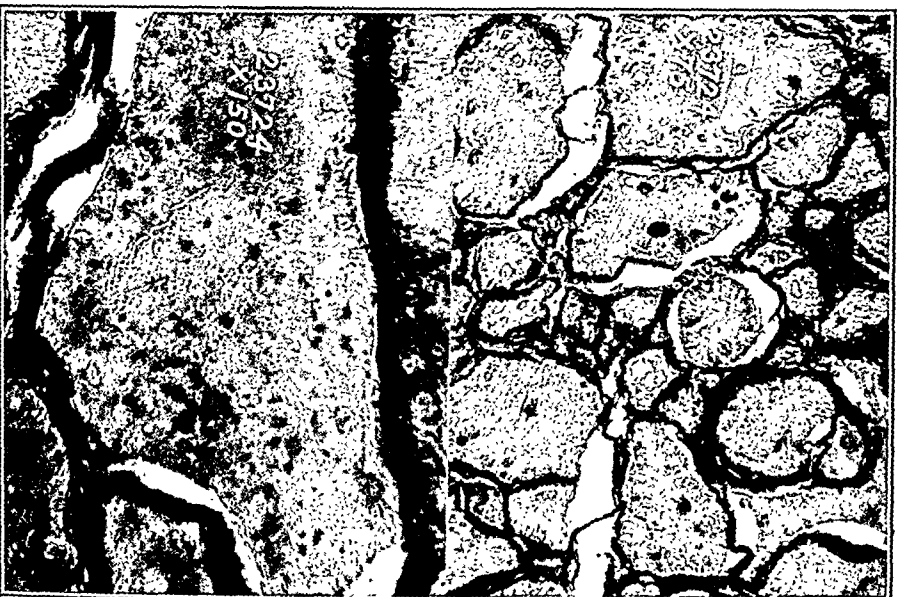


FIG. 44.—Photomicrographs.

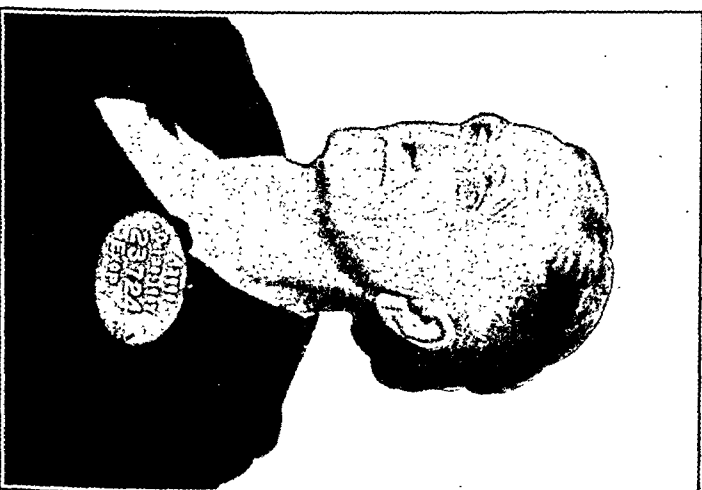


FIG. 45.—Portrait before operation.





absorbed from the glandular alveoli. The whole study was an attempt to determine, in as unbiased a manner as possible, whether or not any such definite relationship really exists between the varying pathological changes in the thyroid gland and the varying symptoms in Graves' disease.

For finally determining the value of these conjectures the following method was adopted: Dr. H. S. Plummer, who had written the original office histories in the majority of the cases, kindly reviewed his own histories as well as those of the other clinicians, and grouped them as follows: Grade 1: Acute cases of (1) mild, (2) moderate, (3) severe, or (4) very severe degree. Grade 2: Cases which had been severe, but at the time of examination showing remission of symptoms. Grade 3: Cases of previously severe hyperthyroidism, but with symptoms now chiefly of severe vital-organ-lesion type (heart, nervous system, etc.), rather than hyperthyroidism. Grade 4: Mild, continuous cases, slowly developing.

When the clinical and pathological classifications had been definitely made, the two were compared case by case. As a result an almost complete parallel was found to exist between the pathological conjectures and the clinical facts in about 80 per cent. of the cases. In about 17 per cent. more the apparent disagreements were readily explicable on reviewing both the clinical and the pathological data. In but 6 of these cases, or less than 3 per cent., there was a disagreement for which, as yet we have been unable to find any positive explanation. In these 6 cases the pathology indicates a more severe type of the disease than is shown by the clinical histories.

Having found that the pathological groups in our series of cases correspond with considerable accuracy to well-marked clinical groups, it is necessary to examine them a little more closely to determine, if possible, what this correspondence may indicate in regard to the pathological development. It will be noted that the groups are in two series: (1) Those essentially with increased parenchyma within alveoli, and (2) those with increased number of alveoli. Each series starts with a group, with but a small amount of parenchyma and secretion increase (A and E), proceeds to a group with a large amount of parenchyma and secretion increase (B and F), and thence to a group like the preceding, with but beginning degeneration (C and G), and terminates with a group characterized by more or less complete degeneration (D and H).

As suggested above the clinical interpretation of this grouping is made on the following working hypothesis, which is merely an elaboration of Möbius' theory:

1. That the symptoms of Graves' disease are associated with increased absorption of an increased secretion of the thyroid gland.
2. That the more functioning parenchyma cells in the gland the larger the amount of its secretion.

3. That the more fluid the secretion of the gland the more readily will it be absorbed.

4. That the cells partly disintegrated and found embedded in the secretion in the alveoli with partially or wholly naked walls are mostly, if not entirely, desquamated epithelial cells.

5. That the increased concentration of the stained secretion by the absorption of its own fluid constituents and by the desquamation of the alveolar epithelium, probably tends to reduce absorption from the gland as a whole.

6. That the dense, gelatinous, well-stainable secretion, the so-called "colloid" in any thyroid gland is not, probably, strictly speaking, a normal product, but the complement of the absorbed portion.

7. That when dense, basic-stained, colloid material fills the alveoli of the thyroid gland it probably should be regarded as evidence, not of present secretion, but of blocked absorption and parenchyma destruction.

8. When, therefore, we measure either histologically or chemically, the relative colloid (globulin) content of the thyroid gland, we should bear in mind that we are probably not determining factors which have actually caused the symptoms, but only their associated phenomena.

On such a basis a very simple hypothesis of the development of Graves' disease may be formulated as follows:

1. Following a metabolic, chemical, or extra-organismal irritant, thyroid parenchyma proliferates, over-functionates, and degenerates.

2. This process primarily resembles simple, adenomatous proliferation, or reminds one of adenopapilloma.

3. Either process may start in a gland not previously enlarged by retained secretion, or in one which is already distended with non-absorbed secretion.

4. The severity of the symptoms depend upon (a) the amount of absorbable secretion, and (b) the patient's ability to neutralize the secretion.

I would urge that, in making histological examinations of the glands from cases of hyperthyroidism, the gland should be studied throughout, and that the statement of findings in such cases should express the observer's estimation, not of what was found in this or that area in the gland, but rather of the total secretory power and amount of absorbable material in the gland.

While our cases are too few from which to draw positive conclusions, yet so far as they go they seem to warrant us in making the following tentative statements from the clinical standpoint:

1. Very early acute cases show pathologically hyperemia and cellular hyperplasia, if not throughout the gland, at least in much of it, providing, of course, the more enlarged lobe has been removed.

2. Later acute, moderate, severe, and very severe cases show

greater parenchyma increase, and in many instances evidence of increased absorbable secretion. Speaking broadly the parenchyma increase is in direct proportion to the intensity of the symptoms. The relatively few variations from this rule may be accounted for by the varying resisting power of different individuals. When relatively small amounts of absorbable secretion are found in alveoli whose walls are crowded with actively functioning cells, we may fairly assume that the secretion has already been absorbed.

3. Cases which clinically are showing any remission of toxic symptoms, show somewhere within the gland more or less evidence of decreased function in the exfoliation or marked flattening of parenchyma cells, or of probably decreased absorption, by the presence of thick, gelatinous, stainable secretion, the so-called "colloid."

4. Patients who have recovered from their toxic symptoms and are now suffering principally from long, previously acquired heart or nerve lesions, or from myxœdema, although no myxœdema cases are included in our present list, show exfoliated or much flattened (probably non-secreting) epithelium and large quantities of well-stained, thick, gelatinous, probably non-absorbable, colloid. In this class of cases it seems as futile to search for previous, causative parenchyma increase as to look for diphtheria membrane in the throat of a patient suffering from post-diphtheritic paralysis.

5. The recently developed, very mild, or moderately mild, cases of long standing show pathologically almost always some total parenchyma increase by the multiplication of alveoli, but apparently not greatly increased functioning power of the individual parenchyma cells. Goitres of the adenoid type (Groups E, F, and H) apparently pass through the same changes of hypertrophy and degeneration as those of the papilliferous type (Groups A, B, C, and D).

6. Simple goitres should be regarded as multiple retention cysts filled with non-absorbable secretion, cell detritus, etc.

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## INFERIOR POLIO-ENCEPHALITIS IN A CHILD OF FOUR YEARS, WITH RECOVERY.

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A BOY, aged four years, was admitted to Dr. Judson's service in St. Christopher's Hospital, October 29, 1907, and presented an

unusual combination of symptoms. His family history was negative. He had been healthy from birth and had not had any infectious disease. Three weeks before his admission to the hospital the mother noticed that he was "stiff" (as she described it) on coming down stairs in the morning, and thought that he had rheumatism, because he seemed "stiff and sore." After breakfast, however, the child played about outside as usual. The mother soon noticed that he staggered and that his right eye was turned inward. He held his head to the right side, although he was able to move it in all directions. He continued to play about, but seemed dull. During this time he had a cold and a paroxysmal cough. He never had any convulsions, did not complain of pain or headache, did not vomit, ate well, voided his secretions normally, and did not appear feverish. It is questionable, however, whether he did not have a slight rise of temperature. The mother failed to notice any weakness of his extremities. He was particularly stupid just before he was brought into the hospital, and staggered a great deal on the way there.

The examination of the boy showed him to be well developed, and of good color. There was a slight scalp wound in the left temporal region, from a fall on the sidewalk five weeks before his admission. His throat was clear. His lungs, heart, and abdomen were normal. The spleen was not palpable, the liver barely so. The lymphatics and the epiphyses of the long bones were not enlarged.

The mental condition of the child was very dull, and he had incontinence of urine and feces. There was no loss of power in the extremities, and the grip was good. There was no wasting. Measurements showed both sides to be equal. The electrical reactions were normal. There was a marked ataxia of the cerebellar type, and Romberg's sign was present. The knee-jerks and Achilles jerks were absent. The skin reflexes were normal. There was no Babinski and the normal plantar reflex was obtained. There were no sensory or trophic disturbances and the tactile, pain, and temperature senses, as well as the sense of position, appeared normal. There was a coarse tremor of the hands when the patient was disturbed. Coördinate movements were well performed when the child was in the recumbent position. In addition to the mental hebetude, incontinence, cerebellar ataxia, and loss of deep reflexes, there was paresis of both external recti, more marked on the right side, with deviation of the tongue to the left and an extremely slight obliteration of the nasolabial fold on the left side. The other extra-ocular muscles acted normally, and the pupils were equal, reacted to light, and accommodated freely. The eye-grounds were examined by Dr. Kraus, and found normal. Dr. Stimson found hearing equal and normal on both sides, with a normal tympanum. Four examinations of the urine gave negative results. On November 9, 1907, an ounce of clear cerebrospinal fluid was withdrawn by lumbar puncture, but this failed to present abnormal features. No

cellular elements were found. The temperature showed slight elevation on admission and this persisted for two weeks. The average was from 99° to 100°. It then gradually dropped to the normal line. The pulse ran from 100 to 120, and the respiratory rate from 25 to 30.

A few days after admission the patient became a little brighter, and a week after admission the paresis of the external recti was less marked. There was at this time also only an occasional incontinence of urine and no longer any tremor. The boy continued to grow brighter, and on November 22 the ocular palsy was much improved. The tongue at this time was still slightly deviated to the left. The ataxia persisted and the deep reflexes remained absent. His condition continued practically unchanged until his temperature again rose, in the first week in December, when an uneventful attack of typhoid fever set in, and lasted a little over three weeks.

An analysis of the case quickly shows that we were dealing with motor symptoms confined to the functions of three different cranial nerves; the twelfth on the left side, both sixths, and possibly the left seventh (the latter was extremely slight). The involvement of the sixth was very much more marked on the right side, while the twelfth was affected on the left. Other motor involvement there was none, and the only additional symptoms to help localize were the ataxia and loss of deep reflexes.

A single circumscribed lesion would not account for the combination of symptoms; for the sixth nucleus was much more markedly involved on the right side, while the involvement of the twelfth nerve nucleus was on the left. We were, without doubt, dealing with a pathological condition in the lower part of the pons and the upper part of the medulla: it would be almost impossible to account for the symptoms by pressure from elsewhere, such as a tumor of the cerebellum, since that could hardly press upon the hypoglossal and facial with more marked pressure on the sixth of the opposite side, and this without affecting the pyramidal tracts. As the child failed to present other usual symptoms of cerebellar tumor, such as optic neuritis and vomiting, that diagnosis was excluded. His subsequent complete recovery confirmed this opinion. There was no evidence of meningitis at any time.

We were then obliged, by the combination of the paresis of these few cranial nerves and the cerebellar ataxia, to locate the disease in the pons and medulla. There was no history of syphilis or tuberculosis, and the boy had been a particularly healthy child. A thrombosis or embolism could not be accounted for, as there was no cardiac or arterial disease. The child showed no evidence of syphilis. Furthermore we could not assume that there was a hemorrhage into the pons caused by the violent straining of a whooping-cough. Also, as the condition did not come on suddenly, a hemorrhage was extremely unlikely. Therefore, we were forced to think of polio-

encephalitis, for there was irregular involvement of a few motor cranial nerves whose nuclei are closely related by position in the lower pons and upper medulla; and the derangement of functions did not extend to the ventral portion of the pons, but left the pyramidal tracts apparently uninvolved.

The course of the disease, with mild febrile disturbance and the marked mental hebetude, which at one time after the boy's admission to the hospital approached stupor, confirmed the diagnosis of polio-encephalitis. The disorder also developed at the end of an epidemic of poliomyelitis, which occurred in Philadelphia and in other parts of Pennsylvania in the autumn of 1907.

The modified views of Strümpell<sup>1</sup> (whose earlier conception of encephalitis as a process involving the cortical area alone, was not concurred in) have been confirmed and it is now an accepted fact that a certain number of cases of cerebral palsy are due to acute non-suppurative encephalitis. The presence of this morbid state has been demonstrated by the pathological findings of Ganghofner, Sachs, and Fischl at least; and the simultaneous appearance of such foci of disease in the brain with the lesions of acute anterior poliomyelitis has been observed by Redlich and others. A number of cases of acute anterior poliomyelitis in the adult accompanied by inflammation in the medulla, pons, crura, cerebral ganglia, or cortex have been studied pathologically. Such was a case in an adult reported by Sherman and Spiller<sup>2</sup> in 1900. As a result of his studies Spiller concludes that "poliomyelitis is closely related pathologically to the non-purulent form of encephalitis, and to the polio-encephalitis superior of Wernicke," and that "poliomyelitis in the adult is essentially the same disease as poliomyelitis in the child."

Any part of the brain can be the seat or point of origin of this trouble. After referring to the frequency with which the central ganglia alone are affected, Oppenheim<sup>3</sup> concludes that the gray matter in the wall of the third ventricles and the aqueduct of Sylvius is the seats of predilection, whence the disease may descend to the spinal cord, that involvement of the cerebellum is less frequent, that the process may extend to the optic nerves and retina, that as a rule there are several foci, and, that although the gray matter is principally involved, the disease may extend in the neighboring white matter.

In this connection it is well to call attention to the fact that the pathological findings in anterior poliomyelitis have shown that the inflammatory changes are really a myelitis principally limited to the gray matter of the cord, particularly the anterior horns, but that the other adjacent portions of the white matter, or even the

<sup>1</sup> Practice, thirteenth edition.

<sup>2</sup> Phila. Med. Jour., November, 1900.

<sup>3</sup> Oppenheim in Nothnagel's System.

membranes, do not entirely escape. That the cause acts through and upon the bloodvessels and does not pick out the anterior horn cells and leave the surrounding tissue unaffected, has been established in spite of the fact that the clinical manifestations point to the anterior horn cells alone. Oppenheim also says: "It is not infrequent to find a single circumscribed process within the pons and medulla, but the size and extent of any focus may vary in wide limits." We think that our case gave evidence of the presence of inflammatory changes in the lower part of the pons, creeping slightly into the medulla on the left side (judging from the clinical signs), and that the lesion was due to an encephalitis. Polio-encephalitis may run an acute or subacute course, and, although in severe types it may end in death within two or three weeks, it is capable of ending in complete or partial recovery and this in cases of more extensive involvement than ours. Comby<sup>4</sup> and Medin report cases which recovered without any remaining paralysis. Abt,<sup>5</sup> of Chicago, reports two recoveries with residual paralysis. Frederick Taylor,<sup>6</sup> of London, records a case of encephalitis which recovered after a prolonged period of ataxia lasting over three years.

Our case, which was rather mild, ran six weeks (the rise of temperature lasting only two) with decided improvement, when the temperature again rose and a mild attack of typhoid fever set in, during the course of which there were no new nervous manifestations. Upon complete recovery from the typhoid the ataxia had entirely disappeared, as well as the cranial nerve palsies. The last symptom to disappear was the absence of the tendon reflexes, but by February 1908, the knee-jerks, although somewhat weak, were unmistakably present.

Pathological study of the lesion shows that there is cellular infiltration, which may or may not be intense, and is particularly marked along the vessels and in the perivascular sheaths. The vessels are engorged and there are frequent hemorrhages. The cellular infiltration may be marked in the nuclei. The nerve cells and neuroglial tissue may be, in the beginning, swollen, or the nerve cells may be shrivelled, with a disappearance of their dendritic processes, and lack of distinct nuclei. They may ultimately disappear. The essential pathological process in encephalitis is the breaking down of the nervous elements, and extensive granular degeneration. From a number of observations in which the complete function of the nerves was restored, it seems that the lesions produced by encephalitis may be completely absorbed with a restoration to the normal condition, or there may be local necroses or softening, or the focus may be obliterated by connective-tissue formation.

When we come to infer the pathology of a case such as ours (of

<sup>4</sup> Archives de médecine des enfants, 1907.

<sup>5</sup> Archives of Pediatrics, May, 1907.

<sup>6</sup> Lancet, 1904, ii.



the inferior type) it is well to remember that the inflammation may extend farther than the clinical signs indicate.

It is difficult in a short space to give any summary of the symptoms of this disease, because they are so varied in their combinations. The process may begin above, starting for instance, with the oculomotor region, and go down finally causing atonic paralysis of the extremities; or, on the contrary, it may begin below and travel upward, presenting the course of Landry's paralysis. In typical cases only motor functions are involved. There may be different combinations, more or less symmetrical, of paralysis of the cranial and motor spinal nerves. When the cranial nerves are involved, there may be ophthalmoplegia and glossopharyngeal-labial paralysis. Thus the signs of bulbar disease may be difficult articulation, swallowing, or breathing. A hemiplegia may accompany the other symptoms. The disease in its acute manifestations may be initiated by headache, vertigo, nausea and vomiting, fever, general weakness, and more or less stupor. Its onset, though often very rapid, is, on the other hand, not apt to be as sudden as in hemorrhage, and the fact that it may develop through days or weeks is a diagnostic point in favor of encephalitis against hemorrhage. Stupor may deepen to loss of consciousness, with restlessness and delirium, and there may be general convulsions and retraction of the head. Paralysis occur early, but may not at first be apparent. Not infrequently the pulse is slow, but the respiration is apt to be rapid.

The combination of palsies in polio-encephalitis inferior is very variable, and a search of the literature has revealed a very limited number of cases resembling the one here reported. In a case of Leyden's, a boy, aged fifteen years, there was difficulty in swallowing, rigidity of the neck, ataxia, paralysis of both facials, of the hypoglossals, and of the soft palate and vocal cords; later also paralysis of the sixth nerves. The disease lasted eleven days, and the autopsy showed an encephalitis in the region of the medulla.

Dinkler<sup>7</sup> (from Erb's clinic) reports a case of acute inferior hemorrhagic polio-encephalitis of wide extent. A healthy child, aged two and a quarter years, fell down a flight of stone steps, receiving a slight scalp wound, and was unconscious a short period without vomiting or convulsions. After this he was altered psychically, had headache, vertigo, enuresis, occasional vomiting, and a very staggering gait. These symptoms lasted two and one-half years, when, after a vomiting attack, speech became affected, chewing and swallowing difficult, and great restlessness set in. The child died, after two feverish days, in deep coma. The gray substance of the medulla, the posterior horns of the cervical cord, and the floor of the fourth ventricle showed recent bloody extravasations with changes and rupture of the bloodvessel walls. Although the last eight pairs of

<sup>7</sup> Deut. Ztschr. f. Nervenheilkunde, 1895, vii.

cranial nerves were thus surrounded the author says they suffered practically no destruction, because death occurred from intracranial pressure before there was time for this to take place.

The following is a case of Batten's<sup>8</sup>: A child of five years was taken ill with fever, and two days later suddenly developed a right-sided facial palsy, with difficulty in swallowing due to weakness of the right side of the palate. There was no paralysis of limbs or eye muscles. Vomiting was present, but there was no loss of consciousness. Death occurred three days later from respiratory failure. There was complete destruction of the right seventh nucleus, in the region of which there were hemorrhages, thrombosis of smaller vessels, and round-cell infiltration. The engorgement of the vessels produced apparently little change in the left seventh or either of the sixth nuclei. There was also considerable vascular engorgement with exudation of round cells in the medulla in the region of the ninth, tenth, eleventh, and twelfth nuclei, without destruction of these. There was perivascular exudation in the gray matter of the upper cord. Batten remarks that the lesion was of vascular origin and exactly corresponded in appearance with that found in an acute anterior poliomyelitis and in acute polio-encephalitis superior. He alludes to the fact that the former disease occurred frequently during the preceding August, and considers this case to be of the same nature.

The cause of polio-encephalitis, excluding alcoholism, which is responsible so frequently for the Wernicke type of the disease, is mainly the infections and especially influenza. But such an infection was absent in our case. We are in the dark, however, as to the specific cause of anterior poliomyelitis, which so often occurs in epidemics, and the case herewith reported appeared at the end of a severe epidemic of poliomyelitis. It seems hardly justifiable to regard the fall that the child sustained, five weeks before his entrance to the hospital, as an etiological factor. It was only on the pavement while he was playing in the street, and there were no symptoms of concussion; he never became unconscious and was unchanged after this tumble until the disease began two weeks later. He had been in the hospital four weeks when his typhoid developed, so that no claim can be made of any causal relation between the two affections. The total duration of the disease was about three months, since there was no ataxia nor any trace of the palsies upon his return, at the end of January, from the country, where he had been sent for a fortnight's convalescence.

We think this case is of interest because it forges one more link in the chain that unites poliomyelitis and non-suppurative encephalitis, because it shows the inferior type of polio-encephalitis, because it illustrates that this disease may run a comparatively mild course to complete recovery, and from the fact that it followed an epidemic of poliomyelitis.

<sup>8</sup> *Lancet*, October and December, 1902.

## THE GONOCOCCUS AS A FACTOR IN INFECTIONS FOLLOWING ABORTION OR FULL-TERM DELIVERY.

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PROBABLY no subject of equal importance in medical science shows such diverse opinions as that regarding the cause and means of prevention of infection following the discharge of the products of conception from the uterus. Since Mayrhofer in 1863, Coze in 1869, and more especially since Pasteur in 1879, found the streptococcus in the lochia of women suffering from puerperal fever, this organism has been looked upon as the most important bacteriological factor in this disease. In consequence the attention of numerous investigators has been directed toward the presence of this coccus in the vaginal discharge of pregnant and non-pregnant women. The results of examination have not been uniform, and opinion has been varied regarding the possibility of auto-infection and the value of antepartum douches. Although many observers have proved the prevalence of gonorrhœa in modern society, few have been able to show that it is of definite importance in the production of more important forms of puerperal fever.

Experiments by Duhrssen, Bumm, and others, as well as my own observations appear to prove that the normal vaginal, cervical, and urethral epithelium is not attacked by the ordinary pyogenic cocci. When, however, the resistance of the parts is overcome by such an organism as the gonococcus, other bacteria seem able to produce their characteristic lesions. This fact, I believe, is of importance in our consideration of postpartum infections and will help, in part, to explain the diverse opinions held by various authorities upon the question of auto-infection.

The number of cases in my series is small; the results, however, are very suggestive. I believe that the careful examination of the lochia at the onset of fever would demonstrate the gonococcus in a large number of cases. It does not seem unreasonable to suppose that the streptococcus and other pathogenic organisms, which are constantly present in the rectum and the external genitals, should be ready to invade the vagina whenever an opportunity is given. The gonococcus present in the cervical glands or other part of the genital tract takes advantage of the bruised condition of the tissues after labor and sets up an inflammatory process. This process paves the way for a secondary infection by more pathogenic organisms, such as the streptococcus. These secondary invaders having gained entrance, the disease becomes more serious and presents graver symptoms.

The mortality figures of hospitals, in other ways of equal merit, do not materially differ whether douches are used during the latter days of pregnancy or not. At the same time, although the installation of aseptic methods has enormously reduced the mortality from puerperal infection, there still persists a certain number of cases occurring year by year. Many of these cases occur in women in whom labor has been spontaneous or even precipitate. Again, the mortality rate does not give an adequate idea of the incidence and importance of puerperal fever. Many patients are only saved after the most careful nursing and constant attention. Others after a severe illness for a few days are apparently cured and leave the hospital well. A still larger class run a mild fever for two or three days and are discharged after an otherwise normal puerperium. It is women of these classes who return within a few weeks or months to consult the gynecologist for inflammation of the uterine appendages, pelvic peritoneum, or the uterus itself. How rarely is a pelvic abscess or pyosalpinx found in women who have never been pregnant!

No matter what the opinion held by obstetricians regarding the value of douches in healthy women, all are of the same mind regarding the management of gonorrhœa. All admit that this condition demands active treatment. As a rule, however, the failure to carry out such treatment is supposed to result in a mild form of infection from which the patient may be expected, in the great majority of cases, to recover in a few days. The presence of the gonorrhœal condition is usually inferred from the presence of an acute vaginitis or vulvovaginitis, with redness and perhaps swelling of the vaginal walls or vulva, accompanied by a profuse creamy, greenish-yellow discharge. In the absence of such vaginitis, signs of urethritis are looked for.

The gonococcus is a much more frequent inhabitant of the vagina than such a diagnosis would lead one to believe. In a series of examinations<sup>1</sup> made by me of the vaginal discharge of 113 women, the gonococcus was isolated fifty-two times. These cases represent the average class of women applying for treatment for pelvic disease at hospital clinics. This group of cases consisted of 13 of acute vaginitis, from 8 of which the gonococcus was isolated; 36 subacute cases showed the gonococcus in 22; from 44 cases suffering from chronic pelvic disturbances of one kind or another the gonococcus was isolated twenty-two times; 20 cases showing no evidence of inflammation, examined as controls, showed no gonococcus. The results of this series of examinations show that the gonococcus is a common factor in the production of pelvic disease. More important, however, these experiments prove that it is possible by means

<sup>1</sup> A Contribution to the Bacteriology of the Female Genital Tract, Jour. Med. Research, 1908, xviii, 291.

of a careful technique to demonstrate this organism in the majority of cases in which it is present.

The method of isolation employed in the above series of cases, as well as the cases reported in this paper, is simple. The material to be examined is procured upon a sterile swab, such as is used in ordinary routine bacteriological examinations. The cervix is exposed by means of a bi-valve speculum. After thoroughly sterilizing the external genitals the cervix is cleansed with a series of sterile cotton sponges. The point of the swab is then passed through the os and thoroughly rubbed over the endometrium. A tube resembling that used by Döderlein has been used in a number of cases. This



FIG. 1.—Showing the isolating of colonies of the gonococcus by the stroke methods on blood agar plates.

tube has shown itself to be inadequate as a means of obtaining material, as it only procures the most fluid part of the discharge which is well known to contain the bactericidal properties in largest proportions. The result has been that although numerous organisms are usually seen in the smears prepared from the fresh material, rarely is any growth effected. Within as short time as possible the material on the swab is surface seeded over blood agar. With some experience isolated colonies may be readily procured by this method. As a rule, within twenty-four to forty-eight hours, gonococci, if present, will appear as small, bluish-gray, semi-transparent colonies from 0.5 to 1.5 mm. in diameter (Fig. 1). The observer accustomed to the growth of the gonococcus and other organisms resembling

it will rarely be in doubt as to the nature of the bacteria when a typical growth is produced on blood agar. The results of a very complete test of the relative value of cultural methods of identification, and stained smears of fresh discharges in the above-mentioned series, show that the fresh-stained smear preparation is of little value. In the examination of uterine lochia, the fresh smear is of more help. Here also, however, no definite diagnosis can be made without cultivation of the organisms. The same features which render the examination of the fresh lochia from the uterus of more value than that of the vaginal discharge in general, that is, the larger number of gonococci usually present and the smaller number of contaminating organisms, renders the isolation in cultures correspondingly more easy.

During the past year I have had the opportunity of examining the lochia from 14 cases of severe endometritis following abortion or full-term labor. In all cases the women suffered from definite constitutional disturbances. In all the temperature rose to above 103°. Three patients died and came to autopsy; 2 others developed metastatic pyogenic processes. In addition to the 14 cases examined during life, the bacteriological factor has been determined in 6 other cases coming to autopsy. Of the 20 cases, 4 followed abortion; the other 16 were in women delivered at full term.

The organisms isolated were as follows: Streptococci, ten times in 7 fatal cases; pneumococci, twice in 1 fatal case; *Bacillus aërogenes capsulatus*, 1 fatal case; gonococci five times, and 1<sup>2</sup> four times along with the streptococcus; *Bacillus coli* once in almost pure culture; *Bacillus coli* was also found in larger or smaller numbers in practically every case. Staphylococci, both aureus and albus, were found in large numbers, and saprophytic organisms were frequently found.

In addition to the six pathogenic organisms, a Gram-negative coccus, not resembling the gonococcus either morphologically or in culture, was isolated twice.

In a certain number of cases no growth was procured. This was probably due, in a few cases, to the antiseptic douches which the patients were receiving. Four negative results were undoubtedly due to the use of a tube in the collecting of the material for examination. One of the cases which gave no growth was probably due to the gonococcus.

In my series of 20 cases there are 5 from which the gonococcus was isolated, and 1 in which it was almost certainly present. Only 1 of the cases infected with the gonococcus was fatal. Death was apparently due in this case to a secondary streptococcal infection. All patients, however, suffered from high fever and rapid pulse; 5 had chills. The onset of fever in these cases was early with the

\* See Case 11.

exception of 1 case following abortion (Case III); 2 cases (I and V) had a fever of  $102^{\circ}$  before removal from the confinement table. In 1 case (Case VI) the temperature rose to  $102^{\circ}$  on the second day following delivery; it returned to normal the next day, reaching  $104^{\circ}$  again on the eighth day. The remaining 2 cases developed fever on the second and fourth days respectively.

As is usual with all forms of puerperal infection the patients did not realize the severity of their condition. As a rule, they claimed to feel well and protested against being kept in bed. Fever lasted as a rule from one to two weeks. All patients with the exception of one (Case IV), who died, recovered strength comparatively rapidly and were free from fever.

Two cases had a profuse creamy, yellow, purulent discharge. In 2 cases (Cases III and IV) the discharge was moderate or scant in amount and mucopurulent in character. Cases I and II presented the false membrane covering the vaginal walls usually associated with a streptococcic infection.

It has been found in the examination of vaginal discharges of acute vaginitis, that other pyogenic cocci such as streptococcus and pneumococcus are not infrequently present in large numbers; sometimes in such large numbers that they seem to be the only organism demonstrable. The history, subsequent examinations, or course of the disease shows in nearly all cases that the gonococcus of Neisser is the primary pathogenic factor. That a similar combination of the gonococcus with one or more pyogenic bacteria in the endometritis following childbirth occurs, certain of the following cases will prove:

CASE I.—Mrs. C. G., primipara. Bacteriological number 07.799. The patient was admitted to the Montreal General Hospital, service of Dr. Lockhart. She had been confined four days previously and was suffering from a bloody, mucopurulent discharge; her fever was high,  $103.4^{\circ}$ ; her pulse, 120 (Fig. 2). The vaginal walls and vulva were covered with false membrane with numerous underlying areas of excoriation. During the last six months of pregnancy the patient had suffered from a profuse greenish, creamy discharge, with redness of the vaginal outlet and excoriations. She had been treated with douches of creolin and mercury bichloride. Before the patient was returned to bed after delivery her temperature had risen to  $102^{\circ}$ , and her pulse was very rapid. The discharge and the severity of her symptoms increased until her entry into the hospital. She was put under constitutional treatment and frequent douches, and left the hospital well on the twenty-fifth day. A smear stained by Gram's method by the doctor in charge one day postpartum contained gonococcoid organisms. A bacteriological examination of the lochia on the day after admission showed *Streptococcus pyogenes* present in large numbers together with a mixture of various Gram-positive and negative bacilli.

In this case, although the gonococcus was never culturally isolated, it appears justifiable in the light of the persisting acute vaginitis, apparently gonorrhœal, and the result of the smear diagnosis of the physician in charge of the case, to classify it as undoubtedly gonorrhœal in origin. At the time, however, of the patient's entry to the hospital she presented the picture of a phlegmonous vaginitis usually associated with infection by *Streptococcus pyogenes*. That this organism was really the cause of the severity of the patient's symptoms, the bacteriological examination proved.

CASE II.—Mrs. J. G., aged thirty-two years, primipara. Bacteriological number 07.729. The patient, three days postpartum had a chill and developed a high fever (Fig. 3) and rapid pulse with more or less profuse bloody, slightly foul-smelling discharge. Upon the

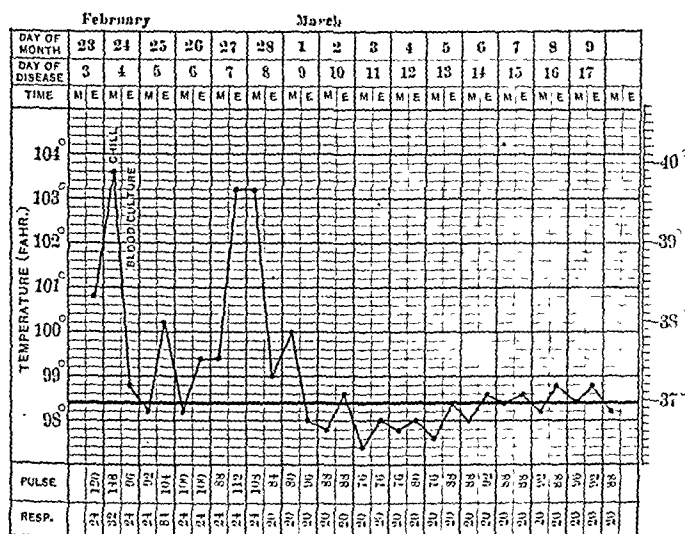


FIG. 2.—Chart of Case I.

fifth day postpartum she was brought to the hospital. When examined on the sixth day the whole vagina was covered with a false membrane of a foul-smelling, sloughy material. Previous to delivery there had been no evidence of any inflammatory disturbance. Delivery had been instrumental and difficult. The strictest technique had, however, been employed. Smears taken from the cervix on the second day after the chill, stained by Gram's method, showed numerous pus cells together with an enormous number of all sorts of organisms including large and small bacilli, many cocci retaining the Gram stain, and a few biscuit-shaped Gram-negative diplococci. Planted upon blood agar, a mixed growth of *Staphylococcus albus* and gonococoid organisms, as well as several saprophytic organisms, resulted.

This case has been included in the series, although the large



number of contaminating organisms made a diagnosis of the gonococcus impossible.

CASE III.—Mrs. A. P., aged thirty-five years, multipara. Bacteriological number 07.686. The patient was admitted to the hospital

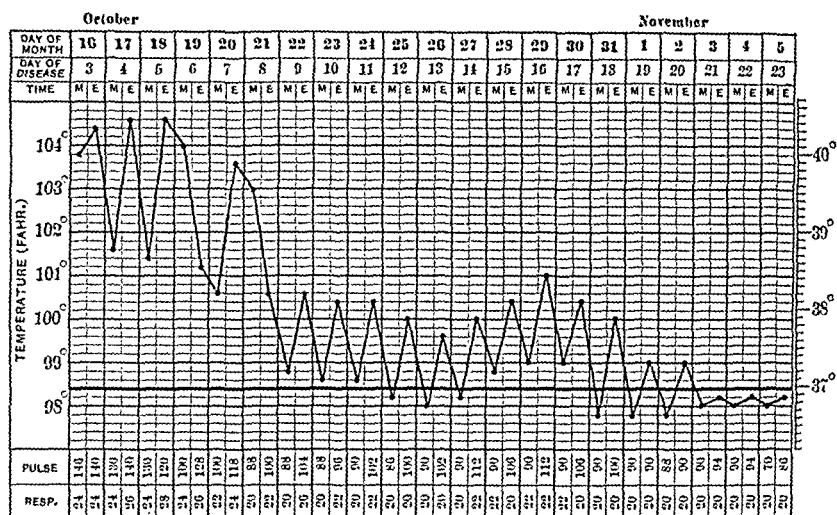


FIG. 3.—Chart of Case II.

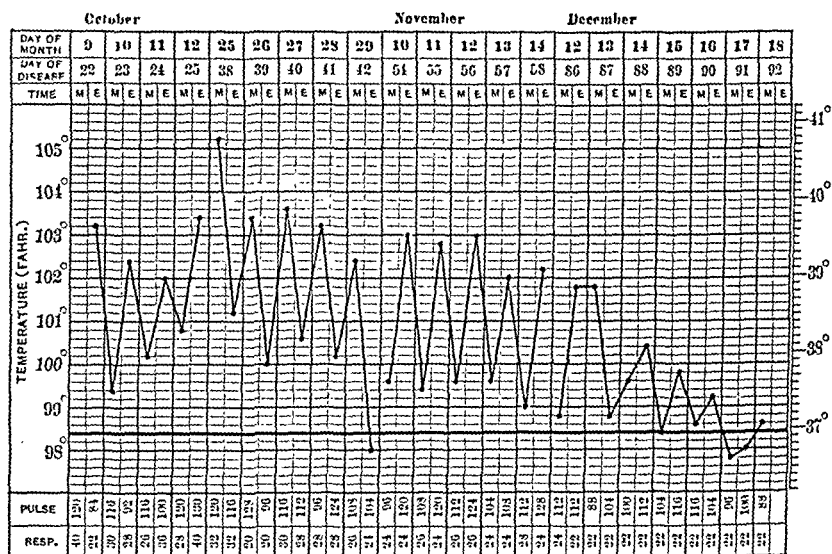


FIG. 4.—Chart of Case III.

suffering from pain in the right leg and arm (Fig. 4). She had a scant, bloody, purulent, uterine discharge. There was no tenderness in the pelvis. The condition in the leg developed into a definite femoral phlebitis. The right wrist became the site of a septic

arthritis. Three weeks prior to admission the patient had aborted, giving birth to a four months' foetus. She had remained in bed two days following the miscarriage. She continued to lose blood for over two weeks, when she developed a fever and a feeling of malaise. She was curetted, but her condition did not improve. She had had four full-term children, the youngest being ten years old. Up to the present abortion she had had but scant leucorrhœal discharge and no other symptoms of pelvic disturbance.

Bacteriological examination of the uterine discharge, one day after admission, showed numerous pus, few epithelial cells. Many Gram-negative cocci were seen occurring in pairs both inside and outside cells. Numerous chains of cocci (six to ten) retaining the Gram stain, were also seen. Planted on blood agar, in twenty-four hours there was a profuse, raised, semi-transparent growth of grayish colonies, measuring from 0.5 to 1.5 mm. in diameter. Stained by Gram's method these colonies showed Gram-negative, bean-shaped diplococci in pairs and fours. A very few colonies of fine dark points made up of Gram-positive cocci in chains were also seen. Blood cultures taken upon two occasions were sterile. Pus from several metastatic joint conditions and abscesses showed streptococci in pure culture, with absolutely no evidence of gonococci.

This case exemplifies two characteristics of gonorrhœal infection. In addition to the fact that an undoubted gonorrhœal endometritis was followed by streptococcic infection of the uterus which ultimately became general, this case demonstrates the chronicity of gonorrhœal lesions and the freedom from discomfort which the patient often enjoys. In all probability the ten years' period of sterility immediately preceding her last pregnancy had been due to what is by some considered to be the conservative salpingitis which protects women suffering from gonorrhœal infection from the dangers of childbirth and pregnancy. This protection in some way being overcome, pregnancy ensued only to be followed by abortion and an almost fatal termination.

CASE IV.—Mrs. L. T., widow, aged twenty-nine years. Bacteriological number 07.955. Autopsy number 08.14. The patient was admitted to the hospital, service of Dr. F. A. L. Lockhart, December 27, 1907. She had aborted at three and one-half months two days before, since when she had considerable bleeding. Before admission her temperature was 100° and her pulse 112. Six hours later these were: temperature, 104°; pulse, 30 (Fig. 5). The uterus was cleansed with the finger and lightly with a sharp curette, and douched with sterile saline solution. A large piece of foul-smelling chorionic tissue was removed. Microscopically this tissue showed numerous polymorphonuclear leukocytes. From December 28 to January 9 the patient's temperature was septic in type, and during this time she suffered from chills of more or less marked severity. She complained of but little distress always

replying when asked regarding her condition, "je me porte mieux." She suffered from very rapid respirations and at one time had a sharp attack of dyspnoea with cyanosis and gasping. On January 9, 1908, a mass was palpable to the left of the uterus. A vaginal incision was made under spinal anesthesia and a small quantity of pus evacuated. An abdominal incision was made and the left ovary, which was filled with pus, was removed. The patient's condition, however, did not improve and she died January 10, 1908. Two examinations were made of the uterine discharge. (B. 07.955.) Stained by Gram's method the fresh pus shows numerous pus, few epithelial cells. A small number of Gram-positive cocci were

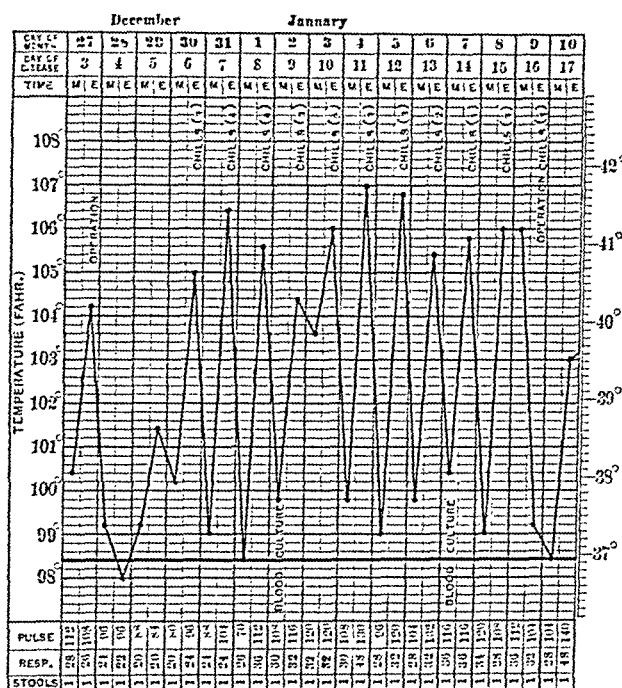


FIG. 5.—Chart of Case IV.

seen, mainly in pairs. There were numerous Gram-negative bacilli with rounded ends, for the most part occurring singly. Moderate numbers of diplococci gonococcoid in shape, decolorizing by Gram's method were seen both inside and outside cells. Planted upon blood agar, no growth occurred at the end of forty-eight hours. The failure to obtain a growth was undoubtedly due to the antiseptics used in the douches.

Second examination (B. 08.8): Stained by Gram's method the fresh pus showed large numbers of pus cells. Numerous Gram-positive cocci in pairs and chains of four were seen. Many Gram-positive and negative bacilli were found. There were also a few

pairs of well-formed, biscuit-shaped, Gram-negative cocci. Planted upon blood agar, in twenty-four hours the surface was moderately covered with isolated colonies of *Bacillus coli*; fine colonies of Gram-positive cocci in pairs; and two fine, grayish, semi-transparent colonies, 1 mm. in diameter, of gonococci. During the course of the disease blood cultures were attempted upon two occasions, but proved negative. Autopsy was performed sixteen hours after death. The anatomical diagnosis was: Acute diffuse peritonitis; puerperal septicemia (*streptococcus*); acute gangrenous endometritis; multiple abscesses of uterus; phlebitis with thrombosis of peri-uterine veins; multiple pelvic abscesses; acute vaginitis; acute suppurative oöphoritis; acute suppurative nephritis; oedema of the lungs; fatty liver; healed gummas of the liver; chronic pul-

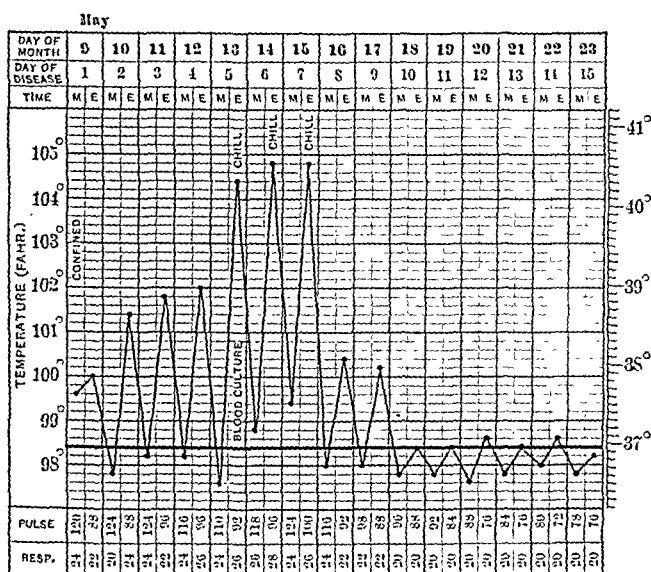


FIG. 6.—Chart of Case V.

monary tuberculosis; chronic pleuritis; chronic pericarditis; acute splenitis; congestion of the liver and kidneys; laparotomy; salpingectomy; vesesection; vaginal section.

CASE V.—Mrs. D. D., aged thirty-two years. Bacteriological number 07.289. The patient was delivered in the Montreal Maternity Hospital of a full-term child. Labor was normal. From the time of delivery the patient suffered from a fever of 100° or more. On the fifth day postpartum she had a chill and the temperature rose to 104.2° (Fig. 6). She complained of little pain and no distress. The uterus involuted well, although a profuse, creamy, greenish-yellow discharge developed. No interference was attempted with the exception of one intra-uterine douche and repeated vaginal douches. The patient left the hospital apparently well. The child, however,

developed a severe ophthalmia neonatorum which led eventually to septicemia and death. On questioning the husband it was found that he was being treated for kidney disease. This was found, on examination, to be a case of frank, acute, gonorrhœal urethritis. Smear shows numerous pus, few epithelial cells. Many bean-shaped Gram-negative diplococci were seen. These were situated both inside and outside the pus cells. Many cells presented a "typical" appearance, being filled with closely packed gonococcoid organisms. Planted upon blood agar, in forty-eight hours, a moderately profuse almost pure growth of gonococci developed. A similar organism was also isolated from the baby's eyes.

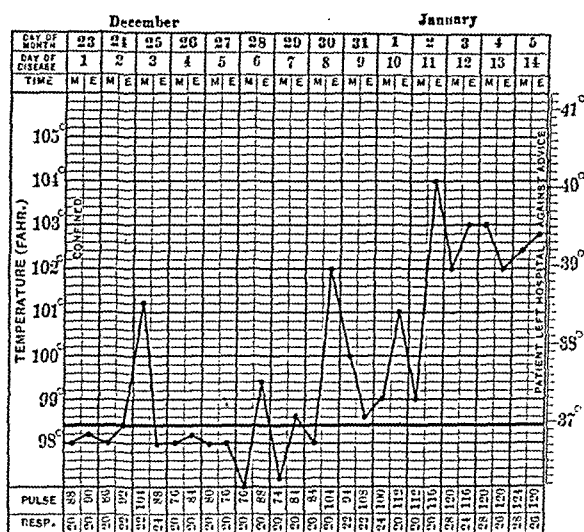


FIG. 7.—Chart of Case VI.

CASE VI.—Mrs. S., aged twenty-six years. The patient was confined in the Montreal Maternity Hospital. Labor was normal. Two days after delivery the patient's temperature rose to 101.1°. It fell to normal the next day, but rose to 102° upon the eighth day; two days later it rose to 104° (Fig. 7). The patient's temperature remained up and she left the hospital, against the advice of the physician in attendance, on the fourteenth day postpartum. The lochia consisted of a profuse, creamy, greenish, purulent discharge which persisted at the time she left the hospital. The child showed no signs of ophthalmia. No history was obtained of any antepartum inflammatory condition.

The smears showed numerous pus, few epithelial cells. Many Gram-negative bacteria with rounded ends were seen, also Gram-positive cocci in pairs. One or two pairs of Gram-negative bean-shaped diplococci were also found. In twenty-four hours a culture upon blood agar showed several large, isolated, greyish, creamy colonies of *Bacillus coli*; also a few white colonies of *Staphylococcus*

albus. Between these larger colonies numerous small, semi-transparent colonies of gonococci were seen.

CASES V and VI demonstrate the severity of the disease which an uncomplicated gonorrhœal infection may produce. The unfortunate ending, too, of the ophthalmia in the child from Case V also brings before us the importance of the gonococcus in the pregnant and puerperal woman.

Although Case II was probably gonorrhœal, I will, for the purpose of this paper, speak only of the other 5 cases. In all of these the infective process began as a gonorrhœal condition. In all the most careful technique had been followed during delivery. Nevertheless 5 patients became septic and ultimately suffered from severe infection. In 3 this infection was undoubtedly due to streptococci.

All physicians dealing with large numbers of pregnant women have seen cases in which fever, at times severe, has followed spontaneous or precipitate labor, in which absolutely no examination of the internal parts had been made. Experience shows, also, that it is in unmarried girls that fever is most frequently met with. It is naturally in women illegitimately pregnant that gonorrhœa is most frequently found. Cases such as these influence Lenhartz and others to support the prophylactic douche. Many cases occur in which retained secundines, filth of the external parts, and other causes are insufficient to explain the development of the infective process.

In 1898 Burr, in an article entitled "Gonorrhœa as a Factor in Puerperal Fever," puts the question which he proceeds to answer: "Notwithstanding advancement along the lines of antiseptics, etc. . . . why is there not greater freedom from septic puerperal infection?" He draws attention to the prevalence and chronicity of gonorrhœa and states the idea, which I have expressed above, in the following words: "The gonococcus will share its possessions in apparent harmony with other pathogenic germs, or at an indefinite period quit the field in their favor."

My own experience, as well as those of many observers, seem to prove that streptococci are rarely found in the upper part of the vagina. The streptococcus, as well as numerous other organisms, is, however, undoubtedly present in the lower part of the vagina and about the vulva. Thus different investigators have had different results owing to different technique. Williams is probably correct when he says "that in those cases (in which pathogenic organisms are found in the upper vagina) the infection is probably carried up by the instrument made use of in procuring material for examination."

Other opinions and clinical experiences, on the contrary, are due, I believe, to the fact that sufficient account has not been taken

of the likelihood of auto-infection occurring in cases of chronic gonorrhœa.

CONCLUSIONS. (1) The gonococcus either alone or as a primary infecting agent plays a much more important role in the production of puerperal fever than is usually appreciated by most observers; (2) various microorganisms especially the streptococcus and *Bacillus coli* are usually present about the vaginal outlet, although apparently infrequently found in the upper part of the vagina of the healthy woman. These organisms are ever ready to attack the tissue whose resistance has been destroyed by the action of the gonococcus. As corollaries there follow (a) the necessity for the most careful examination of the history of the patient and of the vaginal discharge early in pregnancy in all cases presenting the least grounds for suspicion; (b) the necessity for more than ordinary caution in examining externally all pregnant women presenting even the slightest evidence of an inflammatory condition.

I wish to express my thanks to Dr. F. A. L. Lockhart for use of cases in the Montreal General Hospital, as well as the physicians of the Montreal Maternity Hospital for notes upon cases in that institution. I wish also to thank Dr. C. W. Duval for numerous suggestions from time to time.

## A NEW METHOD OF STAINING THE DIPHTHERIA BACILLUS.

By WM. H. RUSH, A.M., M.D.,

OF ST. LOUIS, MO.

THE following are the materials required in a new staining procedure: Grüber's methylene blue; Grüber's eosin, "W. G.," or "rein;" tartaric acid; alcohol, 96 per cent.; and distilled water.

The solutions should be prepared as follows:

(a) Saturated aqueous solution of methylene blue, filtered, 10 c.c.; tartaric acid, 10 per cent. aqueous solution, 10 c.c.; distilled water, 80 c.c.

(b) Tartaric acid, 10 per cent. aqueous solution, 10 c.c.; alcohol, 96 per cent., 50 c.c.; distilled water, 40 c.c.

(c) Eosin, saturated aqueous solution, filtered, 1 c.c.; distilled water, 199 c.c.

Stain thin films—on a coverglass or slide, fixed by the flame in the usual way—ten seconds in a; wash ten seconds in b; stain ten seconds in c; blot and dry. The solutions b and c should be poured on freely. Drying or washing in water between the different steps is unnecessary.

The polar bodies will be stained deep violet-blue; the remainder

1



2



3



4



5



FIG. 1.—Two hours' culture; a combination of portions of two fields.

FIG. 2.—Fourteen hours' culture.

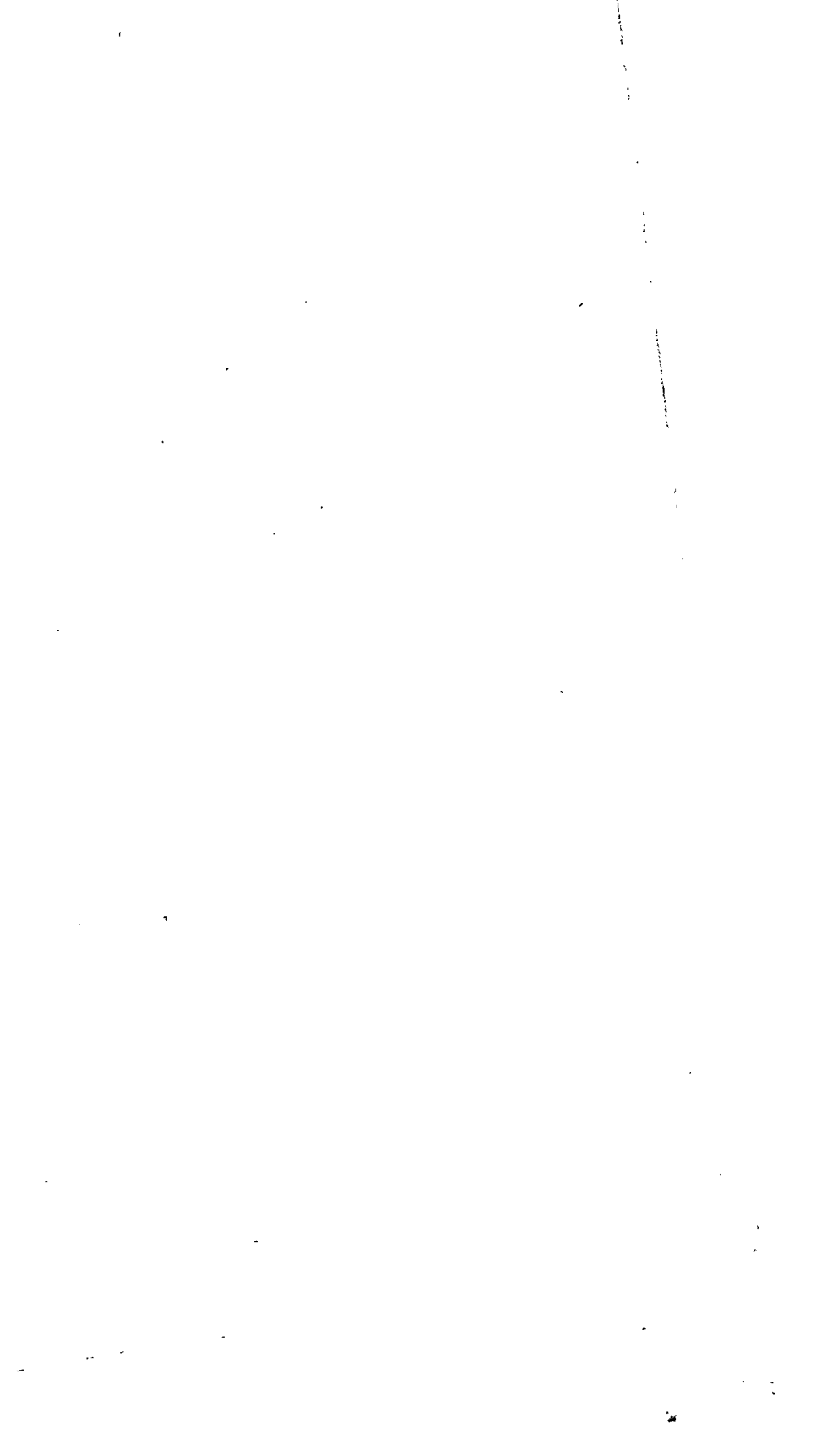
FIG. 3.—Twenty-one and one-fourth hours' culture.

FIG. 4.—Ten days' culture.

FIG. 5.—Smear direct from nasal discharge.

The figures were drawn with camera lucida, Zeiss  $\Gamma_2^1$ —4.





of the bacillus and all other microorganisms that I have observed, with the exceptions mentioned below, intense pink (Figs. 1, 2, 3, 4, and 5). Tissue elements, fibrin, mucus, etc., in case of films direct from the throat or nose, also are stained pink.

I have tried all the easily obtainable organic acids, as well as propionic and butyric, with the above stains, in a great variety of proportions and combinations, and have fixed upon the method described as the most suitable. Butyric acid, substituted for tartaric in solution *a*, and used in simple 1 per cent. aqueous solution in place of *b*, gives somewhat better results than tartaric acid as in the above formula. But the disgusting odor of butyric acid renders its use impossible, except in isolated laboratories.

The method has wide working limits, both as to the composition of the different solutions and as to the timing of the different steps in the process of staining. Solution *c*, however, must not be used too long or too strong.

I have tried this method many times, have controlled it by the stains of Löffler, Neisser, and Hunt, and have confidence in its reliability. I have successfully stained the bacillus from cultures of all ages between the limits of two hours and ten days. The appearance of the bacillus may be best comprehended by reference to the accompanying illustrations.

*Staining Properties of Other Bacteria.* Many cocci, of various habits of growth, occasionally show a more or less distinct blue central portion. The strong contrast-stain easily reveals their true morphological character. I have found a few species of leptothrix which show metachromatic granules with this stain and with Löffler's, but not with Neisser's stain. The relatively small granules and the coarse filaments or segments ought to make confusion of this form with the bacillus of diphtheria impossible.

*Bacillus Pyocyaneus.* I was furnished a pure culture of this organism by Dr. Simon, of the City Bacteriologist's Laboratory, who isolated it from a case of gangrenous appendicitis. Companion smears of this culture, stained by the method herein presented, and by the methods of Löffler and Neisser, all show here and there a bacillus with one or two metachromatic granules, precisely resembling a diphtheria bacillus of the short variety. The same is true, as pointed out to me by Dr. Simon, of smears stained with thionin blue. Its occurrence and mode of growth exclude the possibility of a mistake in diagnosis.

*Pseudo Bacillus.* I have examined a number of strains of this group of organisms, sent me in pure culture by Dr. Alice Hamilton, of the Memorial Institute of Chicago. They stain as follows:

1. Obtained from the throat of a diphtheria convalescent. A few bacilli show metachromatic granules, when stained by the method of Neisser, also with methylene blue and eosin according to the above formula; none, however, with the butyric acid modification.

2 and 3. Scarlatinal otitis media. No metachromatic granules by any method used.

4. Scarlatinal otitis media. A few bacilli show metachromatic granules with Neisser's stain and with methylene blue and eosin.

5. Chronic otitis media. A few metachromatic granules with Neisser's stain, none with methylene blue and eosin.

6. Postscarlatinal otitis media. A few metachromatic granules with Neisser's stain and with methylene blue and eosin.

*Staining of Smears Direct from the Throat or Nasal Discharge.*  
In the examination of 20 cases, 13 positive, 7 negative, my findings agreed with those obtained from the corresponding cultures. In one case which I reported as doubtful, the first culture showed no bacilli at eighteen hours' incubation. A second culture, obtained fifteen hours later, showed a very few diphtheria bacilli after twenty-four hours' growth. I do not, however, advocate reliance upon the direct examination, except in positive cases.

The advantages of the suggested staining method are: Accessibility of the necessary reagents; ease of preparing the staining solutions; wide working limits; and striking and characteristic appearance of the organisms when so stained.

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## THE NATURE OF POSTOPERATIVE FEMORAL PHLEBITIS.

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IN looking up the subject of postoperative phlebitis, I have been impressed with the lack of definite classification of the different cases. The fact is that in most of the current literature and in most text-books the terms phlegmasia alba dolens, thrombophlebitis, phlebitis, and thrombosis, relating to the femoral vein, are used synonymously. One author<sup>1</sup> says that when phlebitis is in the femoral or iliac veins the disease is known as phlegmasia alba dolens. Another author<sup>2</sup> states that thrombosis of the femoral veins is the same as that described in text-books under the name of phlegmasia alba dolens. Kaufman<sup>3</sup> says that phlegmasia alba dolens is a thrombophlebitis retrograde from the iliac to the femoral vein.

It is doubtful whether these definitions are quite accurate, and it is my purpose to show that sufficient differentiation has not been made in the description of the postoperative complications grouped under the headings of phlebitis, thrombosis, and thrombo-

<sup>1</sup> International Text-book of Surgery, 1899, vol. i, p. 892.

<sup>2</sup> Johnson, Surg., Gyn., and Obst., iii, p. 111.

<sup>3</sup> Specielle Pathologie, p. 93, 4th edition.

phlebitis. I expect to prove (1) that many of the cases are really nothing but phlegmasia alba dolens in its proper sense; (2) that in this condition thrombosis is not necessarily present; and (3) that therefore many of the cases are not correctly described.

Pathologically there are three primary conditions: (1) Phlegmasia alba dolens; (2) thrombosis; (3) phlebitis. In addition, there may be secondary phlebitis (thrombophlebitis) from an infected thrombus, and also a phlegmasia in the same manner. Further, thrombosis of some degree may follow an initial phlebitis, and primary phlegmasia alba dolens may lead, through phlebitis, to thrombosis.

Phlegmasia alba dolens is a term very loosely used, and, unless one desires to convert its meaning, should be applied to those cases in which there is an acute swelling of the connective tissue of the thigh due to a descension of a pelvic cellulitis<sup>4</sup> involving first, and often exclusively,<sup>5</sup> the upper part of the thigh. This swelling leads to compression of the veins and sometimes secondarily to thrombosis, but it is a misuse of the term phlegmasia alba dolens to call by this name all primary thrombi in the thigh. Besides Olshausen, Schroeder<sup>6</sup> and v. Winckel<sup>7</sup> are in unison on this point. Virchow<sup>8</sup> in 1862, discussing parametritis, showed that what some had called phlebitis is really a lymph thrombosis, making it all the more improper to discuss phlegmasia alba dolens as primary bloodvessel thrombi. It is just as incorrect, likewise, to speak of thrombosis, phlebitis, and the like when the condition is that of lymphatic involvement only, even though the former conditions become sequels. As mentioned, phlegmasia alba dolens makes oedema first in the thigh and may descend, but not necessarily, whereas primary femoral thrombi produce oedema first in the foot or calf.

To obtain data for my contention, I have read most of the literature relating to the so-called phlebitis after operation. To add here the titles of the articles would be mere repetition, for they are already summarized in some recent literature. (See Morley,<sup>9</sup> Grant.<sup>10</sup>) It is only just to state that in the description of many of these complications specific mention is made of the actual conditions that obtained, and many cases are properly classified; but in a goodly number of histories of cases the statement is made only that the leg is swollen, without distinction as to calf or thigh and without specification of the place where the swelling or edema began, making, for my purpose, some indecision. But some cases, from their description (see Morley, Cases IX and X), and some from their rapid convalescence, can be nothing but phlegmasia alba dolens, and are classed under

<sup>4</sup> De Lee, Notes on Obstetrics, 1904.      <sup>5</sup> Olshausen-Veit, Geburtshilfe, 1902, p. 778.

<sup>6</sup> Geburtshilfe, 4th edition, 1874, p. 716.

<sup>7</sup> Lehrbuch der Geburtshilfe, 2d edition, p. 779.

<sup>8</sup> Virchow's Archiv, xxiii, p. 415.

<sup>9</sup> Surg., Gyn., and Obst., September, 1907.

<sup>10</sup> Jour. Amer. Med. Assoc., xlviii, p. 567.

other headings. Even in those cases in which a thrombus is reported as having been felt it is possible that a compressed vein was found.

Concerning the accuracy of the use of the term phlebitis to describe these postoperative conditions, it seems to me that it cannot be correctly employed. As I understand phlebitis, it alone can never be considered when there is swelling of the leg, for then there must be present either thrombosis or phlegmasia alba dolens also, or both. If that is correct, practically all of the cases reported under that heading are improperly classed, for I believe that all these postoperative complications that have been reported have had associated with them some swelling.

Aside from this latter consideration, which I advance without any spirit of quibbling, the question really at issue is not whether thrombosis ever accompanies, or is the result of, phlegmasia alba dolens. That is a fact and cannot be gainsaid. The point in controversy is that some cases of phlegmasia alba dolens run their course without any thrombotic process whatever, and it is therefore imperative to class these by themselves for the sake of accuracy, if for no other reason.

Concerning the literature upon this point, it appears all to be old, and I can find very little. There are numerous references (Olshausen-Veit, von Winckel), but in practically all the articles that are at my disposal the association of thrombosis and phlegmasia is noted.<sup>11</sup> These are findings at autopsy. Since phlegmasia alba dolens is due to an infection, it would be only natural to find thrombosis in the patients that die, for in the more virulent infections, it is acknowledged the process may lead to thrombosis. Upon the point whether phlegmasia alba dolens ever is found without thrombosis, the affirmative statement of Olshausen, v. Winckel, and Schroeder may be mentioned. Schmaus<sup>12</sup> states that phlegmasia alba dolens is a phlegmon without preceding thrombus. Lee's finding,<sup>13</sup> that a marked phlebitis may exist without thrombosis, is to the point, as is also, more convincingly, the evidence of Klob.<sup>14</sup> This author states that he has seen cases with excessive oedema of the lower extremity without coagulation in the veins, and really answers our question by affirming that thrombosis of the veins is not always associated with phlegmasia alba dolens.

Making a conclusion from these considerations, it is my judgment that the term phlebitis cannot be used correctly in this connection. Further, that though many of the cases are properly described as thrombosis or thrombophlebitis, many, on the other hand, must be designated phlegmasia alba dolens because of the pathological nature of this condition and because of the similar conditions that obtained in the particular cases in question.

<sup>11</sup> Davis, also Mackenzie, quoted by Harvard, *Lancet*, 1906, i, p. 645; also Pourtales, *Archiv f. Gynäkologie*, lvii, p. 36.

<sup>12</sup> *Grundriss der path. Anat.*, 6th edition, p. 699.

<sup>13</sup> Quoted by v. Winckel, *loc. cit.*

<sup>14</sup> *Path. Anat. of Female Sexual Organs*, Translation, 1868, p. 288.

## REVIEWS.

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THE DISEASES OF CHILDREN. Edited by M. PFAUNDLER, M.D., Professor of Diseases of Children in the University of Munich; and A. SCHLOSSMANN, M.D., Professor of Diseases of Children in the Medical Academy of Düsseldorf, Germany. English translation, edited by HENRY L. K. SHAW, M.D., Clinical Professor of Diseases of Children in the Albany Medical College; and LINNÆUS LAFETRA, M.D., Instructor in Diseases of Children in Columbia University, New York. Four volumes. Vol. I, pp. 440; Vol. II, pp. 619; Vol. III, pp. 552; Vol. IV, pp. 543. 61 full-page plates, and 430 text cuts. Philadelphia and London: J. B. Lippincott Co., 1908.

PFAUNDLER and SCHLOSSMANN's *Diseases of Children* is in many respects a monumental work which, having achieved an enviable repute in Germany, has now been made available to the large number of English-speaking physicians unacquainted with German. The contributors number about fifty; all are very well qualified to speak on the subjects that they discuss; some are already well known beyond the confines of their native land. Volume I comprises a discussion of the general pathogenesis and pathology, mortality and morbidity of childhood, and of the symptomatology, prophylaxis, and therapeutics of diseases of children, as well as disorders of nutrition and metabolism; the contributors are Hamburger, Pfaundler, Bendix, Neumann, Prausnitz, Raudnitz, Engel, Camerer, and Sommerfeld. Volume II deals with special diseases of definite ages, general disorders, and infectious diseases, the contributors being Knöpfelmacher, Rommel, Seitz, Japha, Hecker, von Starck, Stölzner, von Noorden, Salge, Moser, von Pirquet, von Bokay, Swoboda, Voigt, Trumpp, Moro, Fischl, Langer, Spiegelberg, Neirath, Ibrahim, Hochsinger, and Schlossmann. Volume III comprises diseases of the digestive, respiratory, and circulatory systems, the contributors being Moro, Finkelstein, Fischl, Pfaundler, Selter, Langer, Stooss, Freund, Schlossmann, Feer, Gallatti, Friedjung, Hochsinger, and Siegert. Volume IV deals with diseases of the urogenital and the nervous systems and diseases of the skin, the contributors being Langstein, Pfister, Zappert, Thiemlich, Galewsky, and Leiner.

The multiplicity of the subjects and the detail in which they are

discussed preclude specific mention of the many meritorious contributions. If one should single out for special commendation the articles on general symptomatology (200 pages) by Pfaundler, general therapeutics (40 pages) by Neumann, scarlatina (53 pages) by von Pirquet and Shick, diphtheria (64 pages) by Trumpp, syphilis (68 pages) by Hochsinger, tuberculosis (45 pages) by Schlossmann, and disorders of nutrition (90 pages) by Fischl, it is done fully conscious of the many other, some shorter, contributions of more than usual merit. Perhaps some of the statements on controversial points will not strike a responsive chord in many readers; others will observe with ill-concealed regret the defects inherent in composite works—disproportionate allotment of space, inequalities in the manner and the method of treating different subjects, overlappings, repetitions, etc. These, however, are nowhere obtrusive, and they are far outweighed by the merits of the work. A noteworthy feature consists of the emphasis placed throughout on the clinical aspects of disease, on the symptomatology, including disturbed physiology, and on diagnosis and treatment—a feature that the general practitioner will prize highly. The editors and the translators have done their work well. The work must be unreservedly commended. A. K.

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**CANCER OF THE WOMB: ITS SYMPTOMS, DIAGNOSIS, PROGNOSIS, AND TREATMENT.** By FREDERICK J. McCANN, M.D., F.R.C.P., F.R.C.S., Physician to In-Patients, Samaritan Free Hospital for Women, London. Pp. 160; 47 illustrations. London: Henry Frowde, Oxford University Press, and Hodder & Stoughton, 1907.

DR. McCANN has prepared a very interesting book. Without attempting the elaborate presentation of Cullen, he has published a valuable reference volume, which is especially suited to the general medical reader. The book opens with an introductory chapter upon the anatomy of the pelvis and its contained organs, and this is followed by a discussion of the various etiological theories. Particular attention should be called to his statement that we must depend upon better medical education, and not upon the distribution of leaflets among women, in our endeavor to cope with uterine carcinoma. With this view we are only in partial accord, since we believe that it is better that many patients be needlessly alarmed than that ignorance and the folklore relative to the menopause should continue the present slaughter. Chapters upon cancer of the neck and body of the womb, and upon spreading of uterine cancer follow. In the last-mentioned chapter, upon page 43, there

is evidently a typographical error in the statement that "before the abdominal operation becomes the method of choice for operation for cancer of the uterus the mortality must be *not less* than the vaginal method, and the freedom from recurrence greater."

The chapter upon diagnosis is pleasing. Here, as elsewhere, there is a profusion of illustration, as well as the introduction of many of the case histories collected from the author's practice. He is an advocate, we are glad to see, of hysterectomy upon the diagnosis of senile endometritis, quoting Matthew Duncan's statement, that "retrospective diagnosis is not of much value to your patient." A chapter is devoted to the microscopic appearances and diagnosis, and the author then contributes a very satisfactory chapter dealing with the surgical treatment of uterine cancer. Amputation by the galvanocautery, the supravaginal amputation of the cervix (Schroeder), and the abdominal total extirpation of the uterus, as well as the vaginal hysterectomy, are described. As will be seen by study of the contained series of case reports, the author has a decided predilection for the vaginal method, but he gives a full description of his technique of the abdominal operation. In connection with the description of the vaginal method, the incisions of Schuchardt are included. Chapter VIII, upon the value of vaginal total extirpation of the cancerous uterus, is composed of several pages of statistics and an account of the extended abdominal operation by the method of Wertheim. The author is not favorably disposed toward what are designated "dissection operations" (as that advised by Ries, of Chicago), believing that there is no analogy between the breast and the uterus in this matter. He is, however, in favor of the Wertheim procedure, being of the belief that the value of the method is mainly found in the removal of the parametrium and upper vagina. He would, indeed, advocate the removal of the upper half of the vagina in vaginal and abdominal operations for cancer of the cervix. This chapter is one of the best in the book, and we are heartily in accord with his statements, except as regards the vaginal method of attack.

Chapters upon the treatment of inoperable uterine cancer and upon sarcoma of the uterus follow, while the last chapter of the book proper is devoted to a most interesting dissertation upon syncytioma malignum, of which the author has had four cases. Chapter XII is largely devoted to the case histories comprising the author's colated experience. The book closes with a very satisfactory chapter upon the after-treatment of operations for cancer of the womb. While space prevents any detailed consideration of the directions contained, we are constrained to say that it is one of the most sane and advanced expositions of which we have knowledge. W. R. N.



A SECOND STUDY OF THE STATISTICS OF PULMONARY TUBERCULOSIS: MARITAL INFECTION. By ERNEST G. POPE, of the Adirondack Cottage Sanitarium, Saranac Lake, New York. Edited and revised by KARL PEARSON, F.R.S. With an appendix on assortative mating from data reduced by ETHEL M. ELDERTON. Pp. 36. London: Dulau & Co., 1908.

It has long been considered a proper thing to begin all statistical articles upon medical subjects with an apology; but without doubt no apology, however abject, is sufficient excuse for many numerical essays foisted upon the medical profession by some of its members. It is a curious fact that while all medical knowledge must, in final analysis, rest upon statistical data, so little attention has been paid to this side of mathematics in our American universities. The result is that not one physician in a thousand can either prepare or understand a paper based upon the most accurate statistical methods now employed. Prof. Karl Pearson, of the University of London, has really founded and developed this branch of medicine. His work upon inheritance in tuberculosis is the best treatment of the subject, and he proves that there is undoubtedly a strong hereditary tendency.

At the time of his death the late Ernest G. Pope, statistician at the Adirondack Cottage Sanitarium, Saranac Lake, was engaged in applying many of these newer mathematical methods to the various problems connected with pulmonary tuberculosis. He left a manuscript nearly completed, dealing with marital infection, which Professor Pearson has completed, enlarged, and published as "A Second Study of the Statistics of Pulmonary Tuberculosis." It has long been taken for granted that the close and prolonged exposure of husband and wife resulted in the infection of the healthy partner in a large number of instances. But the problem is not so simple. Professor Pearson and others have proved, for example, that the inheritance of various physical qualities, as well as this problem, can be dealt with only by a study of the coefficient of correlation, a process involving considerable mathematical knowledge.

Mr. Pope had demonstrated that there is a sensible correlation between the presence of tuberculosis in husband and wife, and that assortative mating plays a very important part. The latter section he had planned to elaborate. Husband and wife, Pearson has found, bear resemblance in regard to eye color and the occurrence of insanity, neither of which can, of course, be assumed to be due to infection. So it is impossible to assume that the resemblance in tuberculosis is due wholly to infection, but, on the other hand, if the tuberculous diathesis be inherited, the parents of tuberculous offspring, who are considered in this paper, must be looked upon as a selected group and corrections applied accordingly. After applying this correction it is seen that the average action of assortative

mating is not sufficient to explain all the resemblance, and that a sensible but not very large effect of infection is present.

The literature has been exhaustively studied, and 41,786 couples have been dealt with. The body of the article is taken up with intricate mathematical formulæ, and the first appendix contains a proof of the fundamental formulæ employed. In the second appendix, Miss Elderton has discussed assortative mating in man in regard to many characteristics, such as health, general intelligence, temper, success of career, insane diathesis, and, finally, in regard to the tuberculous diathesis.

The conclusions of this study are that there is some sensible but slight infection between married couples, that this is largely obscured or forestalled by the fact of infection from outside sources, that the liability to the infection depends on the presence of the necessary diathesis, that assortative mating probably accounts for at least two-thirds, and infective action for not more than one-third of the whole correlation observed in these cases. Professor Pearson calls attention to the fact that to be able to apportion accurately the action of infection, assortative mating, and inheritance, fuller details in regard to the ages of husband and wife at marriage, the ages at the onset and death, as well as the age of the parent at the birth of the child, and the age at onset and death of the child, should all be recorded. Professor Pearson adds that he can only join in the general regret that the medical profession should have lost at such an early age a statistician like Mr. Pope, so capable of throwing light on the numerical aspect of medical problems.

The paper is very valuable. It is to be hoped that in America, as well as in England, an awakening to the value of the application of trustworthy statistical methods to medical subjects will soon be apparent.

L. B.

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DIE ENTZÜNDUNG; EINE MONOGRAPHISCHE SKIZZE AUS DEM GEBIET DER PATHOLOGISCHEN PHYSIOLOGIE. By RUDOLF KLEMENSIEWICZ, Professor of General Pathology in the University of Gratz, Austria. Pp. 120; 2 illustrations. Jena: Gustav Fischer, 1908.

OUTLINING in easy but creditable manner the general process of inflammation in this production, which he modestly describes as a sketch, Professor Klemensiewicz seeks especially to explain in satisfactory manner the basic phenomena of inflammation in the light of modern ideas of physics. His definition of the process runs somewhat as follows: "Inflammation is a process induced by some agency which, in influencing the tissues, coincidentally produces some actual disturbance in the condition of the walls of the blood-vessels, in consequence of which there occur escape of the fluid and

formed elements from the vessels into the surrounding structure and, at the same time, a reaction on the part of the tissue elements still vital in the inflammatory focus. This reaction of the tissue manifests itself partly in biological progressive phenomena, partly in necrobiotic changes." The nature of the alteration of the vascular wall may be of varying grade and varying in its essence, but it is characterized by an increased permeability, in a broad sense is commonly induced by chemical means, is attended by loss of the power of nervous response of the vessel wall and by a consequent paralytic dilatation, by an increase in the circulatory pressure in the area, and by the phenomena of transudation and cellular emigration. Stress is laid upon the phenomenon of a heightened circulatory pressure in the inflamed area, and its experimental demonstration, although a satisfactory explanation of its cause is not given. Such a factor existing, however, the author sees therein a potent element in the explanation of the peripheral accumulation of the leukocytes in the blood stream, the transudation of the fluid, the escape of the white cells, and exceptionally of the red corpuscles. To him it is the moving pressure of the column of heavy red cells which forces from their midst more and more the lighter elements, and mainly determines their passage through the vascular wall, for diapedesis only occurs when the column of blood is circulating, not when, even under pressure, it is stagnant and its elements all mingled in a confused mass. Were the chemotactic theory, or that of cellular motility the real explanation, diapedesis would prevail as well in the latter stage as when there is forceful movement of the blood column. While, thus, the author appeals freely to the idea of filtration under pressure for the phenomena of transudation, he unhesitatingly adverts to the idea of osmosis and diffusion and to tissue contribution for the explanation of the quality of the transudate as found. A considerable part of the pamphlet is devoted to a careful consideration of the theories of lymph production as basic to an understanding of the phenomena of inflammatory transudation, leading to acceptance mainly of the combination of the features just indicated. By detailed physical methods, based upon the ideas of Körner and his followers, the author demonstrates how the increased force of circulation within the vessels of the inflamed area lead through the accumulation of the transudate and other extravascular pressure factors upon the venous side of the capillary system to compression of the vessels and hindrance of flow, eventuating in the succeeding stasis as a later stage. These physical demonstrations are particularly illuminating and satisfactory, and doubtless, employed in logical and discreet connection with the factors of other well-known explanations, should be credited. The application of similar ideas to explain the predominant part the bloodvessels play in resorption of transudate follows in easy sequence, the author's views as to "back filtration" being marked particularly by the indication

of the venous side of the capillary area and venules as the seat of the process, and the necessity for especial structural relations between the vessel wall and the surrounding tissue, as well as the existence of a proper difference between the intravenous and the tissue-fluid pressure for its proper procedure.

There are numerous interesting details which one concerned in the precise study of inflammation will follow with interest, but which here cannot be pursued for want of space; there are minor factors which might fairly be criticised, and one wishes for a wider discussion of the fundamental factor of active circulatory pressure and its explanation; but, aside from these, the brochure must be acknowledged an extremely interesting and luminous exposition and one sure to command the attention and respect of students of pathology.

A. J. S.

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DISEASES OF THE SPINAL CORD. By R. T. WILLIAMSON, M.D. (London), F.R.C.P., Assistant Physician of the Royal Infirmary and Lecturer in Medicine in the Victoria University, Manchester, England. Pp. 432; 183 illustrations and 7 plates. London: Henry Frowde, Oxford University Press, and Hodder & Stoughton, 1908.

It is evident that the author of this book had in mind the needs of the medical student. For clearness of diction and excellence of style there are few books which come up to the standard set by this work, and it is, indeed, a pleasure to commend it. It is by no means an exhaustive presentation of spinal cord diseases, but from the very beginning the author presents the cardinal facts sufficiently to make it quite enough for the medical student and the practitioner. It is also one of the few books in which the illustrations are not borrowed, for with one exception every one is original, and there are altogether 183 illustrations and 7 plates. It may also be added, in passing, that the illustrations are unusually good, and, what is more important, they are lucidly explained by their titles.

In the beginning of the book the structure of the spinal cord is taken up, and this is followed by general pathological histology, degeneration of nerve fiber tracts and cells, functions of the spinal cord, symptoms of spinal diseases, with an account of electrical and x-ray examination and lumbar puncture. The diagnosis and localization of diseases of the spinal cord is then briefly discussed, after which the author takes up the various diseases. Here, instead of following the usual method of treatment, he discusses the spinal cord diseases according to their leading symptoms. In the first classification he has those diseases causing symptoms of a transverse lesion of the cord, including in this acute myelitis, abscess, vertebral

disease, tumors, etc.; secondly, he takes those causing atrophic paralysis, both acute and chronic; thirdly, those diseases causing spastic paresis, including in this only primary, lateral, and disseminated sclerosis; and lastly, the diseases in which ataxia is a prominent symptom, including in this the various forms of degeneration in the posterior columns. He has special chapters on spinal meningitis, syphilis, and traumatic affections of the spinal cord. As an appendix he adds the principal methods of pathological examination of the spinal cord, including in this the more important nerve, cell, and neuroglial stains.

In his subject matter the author always assumes a neutral ground; for instance, in the discussion of the causes of tabes he does not commit himself to any particular view, but presents all the different theories, criticising each justly. So it is when discussing the more recent views regarding the centres for the bladder and rectum, in which he assumes that they are probably in the lower portion of the spinal cord, but gives credit to the views of Müller, who believes that they are mostly located in the lower sympathetic ganglia. He fails to make a subdivision of the lower part of the spinal cord into the conus and epiconus, which Minor has recently called attention to, and his chapter on injuries of the cord is too brief. He devotes only two and one-half pages to traumatic neurasthenia and hysteria, a subject which should demand more attention.

T. H. W.

# ERGEBNISSE DER INNEREN MEDIZIN UND KINDERHEILKUNDE.

Herausgegeben VON F. KRAUS, O. MINKOWSKI, FR. MÜLLER, H. SAHLI, A. CZERNY, and O. HEUBNER. Redigiert VON TH. BRUGSCH, of Berlin, L. LANGSTEIN, of Berlin, ERICH MEYER, of Munich, and A. SCHITTENHELM, of Erlangen. Vol. i; pp. 620. Berlin: Julius Springer, 1908.

*Die Ergebnisse der inneren Medizin und Kinderheilkunde* has been evolved from the desire to provide critical discussions of advances in knowledge and present-day opinions of subjects of interest to clinicians in internal medicine in its many aspects. The purpose of the editors, judging from their announcement and the contents of the first volume, is to publish virtual monographs on important topics by those whose inclinations and training make them especially adapted thereto. The projected scope of the publication is sufficiently wide, since it comprises not only the diseases included within its title, but also diagnosis, methods of investigation, such as radiography, bacteriology and serology, general and special therapeutics, general and special biology and pathology, physics, and chemistry. The first volume contains seventeen articles, of which several are

of much interest and importance: The Morgagni-Adams-Stokes symptom complex, by D. Pletnew; digitalis therapy, by Albert Fraenkel; jaundice, by Hans Eppinger; pyloric stenosis in infancy, by J. Ibrahim; the acetone bodies, by A. Magnus-Levy; the treatment of tabes dorsalis, by Frenkel-Heiden; the clinical diagnosis of tuberculosis of the bronchial glands, by O. de la Camp; and pseudo-bulbar paralysis, by George Peritz. Should succeeding volumes maintain the standard set by the first, they unquestionably will be highly prized by clinicians interested in the progress of medicine and critical discussions of the literature.

A. K.

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THE PRINCIPLES AND PRACTICE OF MODERN OTOLOGY. By JOHN M. BARNHILL, M.D., Professor of Otology, Laryngology, and Rhinology in the Indiana University School of Medicine; and ERNEST DEWOLFE WALES, B.S., M.D., Associate Professor of Otology, Laryngology, and Rhinology in the Indiana University School of Medicine. Pp. 575; 305 original illustrations, many in colors. Philadelphia and London: W. B. Saunders Co., 1907.

THE authors of this volume state in their preface that their object has been: (1) To modernize the subject; (2) to correct certain traditional beliefs; (3) to advocate the earliest possible prophylaxis or treatment; (4) to emphasize the importance of a thorough examination and a definite diagnosis as a basis for rational treatment; and (5) to thoroughly illustrate the text. In general, it may be said that they have fulfilled the purposes which they intended. The science of otology is presented in its most modern aspects, and the book is most excellently illustrated. In regard to the second object, "to correct certain traditional beliefs," it may be justly questioned whether anyone who could in any possible way consider himself competent to treat diseases of the ear would require to be told that the old idea "that children would outgrow their aural ailments" is a mistake; and, as to objects three and four, the obvious necessities on which they are based would seem to render it hardly necessary to state them as among the important reasons for writing a new book.

The book is a good practical treatise on diseases of the ear, applicable to the needs of the general practitioner, and also well worth a place in the library of the specialist. The illustrations, particularly the reproductions of anatomical preparations, are especially noteworthy. The descriptions of the operative procedures are excellent, and, while the authors show on every page thorough familiarity with the most modern literature of the subject, they also display much originality, the result of their own large experience.

The book would not be suitable for a text-book for the ordinary

medical student, as the authors' views are so peculiarly their own; but it is eminently adapted for the use of graduates who desire to familiarize themselves with the aspects of modern otology.

F. R. P.

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**PATHOGENIC MICRO-ORGANISMS, INCLUDING BACTERIA AND PROTOZOA.** By WILLIAM H. PARK, M.D., Professor of Bacteriology and Hygiene in the University and Bellevue Hospital Medical College, New York. Assisted by ANNA W. WILLIAMS, M.D., Assistant Director of the Research Laboratory of the Department of Health, New York. Third edition; pp. 648; 176 illustrations. Philadelphia and New York: Lea & Febiger, 1908.

PARK'S well-known and excellent *Pathogenic Micro-organisms* has been carefully revised and considerably enlarged so as to permit of the incorporation of the many advances made in our knowledge of bacteria and protozoa during the three years that have elapsed since the publication of the second edition. New sections dealing with the opsonic index, the bacteriology of the normal intestines, and the elimination of the non-antitoxic substances in protective sera, etc., have been added. As in previous editions, special attention is given to the protozoa—the section dealing with these organisms having been thoroughly revised by Dr. Williams. A glossary of some of the newer and more technical terms has also been added. The book excellently fulfils the purpose intended, and may be cordially recommended to student, practitioner, and health officer as a trustworthy guide to the manifold relations of bacteria and protozoa to disease.

A. K.

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**DIE CHRONISCHE PROGRESSIVE SCHWERHÖRIGKEIT, IHRE ERKENNTNIS UND BEHANDLUNG.** By DR. AUGUST LUCAS. Berlin: Julius Springer, 1907.

THIS monograph is an earnest effort to clear up the obscure and difficult subject of which it treats. Its distinguished author has added to the results of his large clinical experience a most thorough pathological study of the subject, and his work correlates the two. It is needless to say that the conclusions of so eminent an investigator must command the attention of every aurist.

F. R. P.

# PROGRESS OF MEDICAL SCIENCE. --- MEDICINE. ---

UNDER THE CHARGE OF

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**The Action of Hemostatics in Tuberculous Hemoptysis.**—M. L. GUINARD (*Medical Press and Circular*, 1908, lxxxvi, 316) divides the means employed into three groups: (1) Agents that act on the blood; (2) agents that modify the circulation; and (3) special adjuvants. With the first group comprising many local and general coagulants, the calcium salts, saline solutions, gelatin, and gelatinized serum, the author has had few, if any, good results. In the second group, the vasoconstrictors and vasodilators are taken up at length. The constrictors, such as ergot, ergotin, adrenalin, antipyrin, digitalis, and digitalin, Guinard has tried at different times, but with no promising results. As to vasodilators, amyl nitrite, nitroglycerin, and the nitrites have been used with great success in the treatment of hemoptysis, the first drug especially having been employed by Guinard for the last three years at the Bligny Sanitarium with no untoward symptoms; it acts with great promptness and efficacy. As regards special adjuvants, under which may be classed the counter-irritants, physical agents, and sedatives, ice has at times been most useful, and in Guinard's experience morphine occupies the foremost place.

In connection with this article on hemoptysis there is another on the uses of amyl nitrite by GEORGE A. GRACE-CALVERT (*Brit. Jour. Tuberculosis*, 1908, ii, 189), who reviews the many previous reports for and against the use of this drug in hemoptysis, in most of which the authors agree that it is of great value in some cases; it may be followed or accompanied by the other general measures for the relief of the trouble. Calvert concludes that the following points are in favor of amyl-nitrite. It acts instantly, producing an immediate fall in blood pressure at the bleeding points, thus giving time for clotting to take place, while the bleeding usually ceases at once. It apparently produces an intense



anemia of the lung parenchyma without any reactionary hyperemia, such as follows the use of adrenalin. The capsules can easily be carried by the patient, who can then inhale the contents of one as soon as the hemoptysis begins, thus starting in the treatment at once and often preventing a worse attack. Calvert considers this drug, then, to be the most efficient of all in the treatment of such cases and by far the best one to administer first.

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**Sodium Chloride and the Gastric Secretion.**—A. MARTINET (*Presse médicale*, 1908, liii, 418) notes that there are two actions of salt: one local on the mucous membranes of the mouth and stomach; and a general action exercised after its absorption into the body. As regards the local action, many authors say that the HCl and the peptic digestion are both diminished by the action of salt, while, on the other hand, some authors assert that these functions are increased. These differences are better understood when it is known that most of the previous work has been done on animals either carnivorous or herbivorous by nature, whereas, in man, who is omnivorous, the conditions are very different. The inhibiting or stimulating local action depends much on the habits, the anomalies of the gastric secretion, the food, and according as the salt is given alone or mixed with food. As regards the general action following prolonged feeding on a salt or salt-free diet, the views are more unanimous that the long-continued use of salt leads to a hyperchlorhydria; that a salt-free diet leads to a hypochlorhydria and diminishes the gastric secretion. Clinically, it is well known that the prolonged suppression of salt in the diet produces pain and vomiting in conditions of hyperacidity, while in other conditions in which the HCl is deficient the use of salt increases it and aids digestion greatly. Martinet's experiments on a healthy man, following out L. Meunier's technique, showed that with certain foods, as meat, the digestion was the same with or without salt, but with other foods, such as milk, eggs, and carbohydrate food stuffs, the digestion was delayed from ten to twenty minutes when no salt was given with them. He therefore concludes that in certain subjects and with certain foodstuffs, the addition of sodium chloride to the diet favors the gastric secretion.

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**Hydremia in Nephritis.**—HALPERN (*Deut. Arch. f. klin. Med.*, 1908, xciii, 585) has made an extensive study of the hydremia of nephritis. He finds in cases of chronic parenchymatous nephritis, in which the kidneys are compensating fully, that the quantity of water, nitrogen, and chlorides remains normal in both plasma and red blood cells. Even with œdema the solids of the blood may be normal, but the plasma is diluted and is relatively increased as compared with the red blood cells. Hydremia without dilution of the plasma affects cases without œdema, and depends on the increased amount of plasma as compared with the red blood cells. Hydremia with dilution of the plasma is found particularly in œdematous patients and is due principally to the retention of water. In the course of chronic parenchymatous nephritis Halpern usually finds the sodium chloride practically normal in the plasma and in the red blood cells—the relative amounts of this salt in the corpuscles and plasma being as 1 to 2 in health, but this ratio may be altered to 1 to 5.

**An Experimental Investigation into the Functions of the Thymus Gland.**—ALEX. MACLENNAN (*Glasgow Med. Jour.*, 1908, lxx, 97) reviews some of the previous work done on this subject and gives the results of his operative measures on animals. He concludes that the thymus, though it may be a lymphatic gland, yet is so specialized that it must have an internal secretion of more or less importance to some of the various functions of the body. The gland is an accessory one, for its functions may be taken up by others without apparent disturbance to the individual; however, the simultaneous removal of the thymus and spleen always results in sudden death, thus suggesting that the spleen itself may carry on at times the functions of the thymus. The thyroid and the thymus are closely associated in many ways, and the results in experiments have shown that the thymus is unnecessary to the general economy when the thyroid is gone, and when the thymus is removed less thyroid suffices. The importance of this relationship is apparent in certain diseases. The sudden death in some cases of Basedow's disease following thyroidectomy, in which the thymus has subsequently been found to have been enlarged, is important on account of the relation of the enlarged thymus and the condition of status lymphaticus; the enlarged thymus after removal of the thyroid gives rise to the same conditions as produce the so-called thymus death. Therefore, in cases in which thyroidectomy is necessary an enlarged thymus should first be sought out and removed before the thyroid is extirpated.

**Polycythemia, Erythrocytosis, and Erythema.**—F. PARKES WEBER (*Quarterly Med. Jour.*, 1908, ii, 85) in an exhaustive critical review first divides the cases of absolute polycythemia into two divisions: (a) apparently primary cases of hyperplasia of the red cells, that is, cases of erythema; and (b) secondary or symptomatic cases of hyperplasia of the red cells, that is, cases of erythrocytosis. The first condition (a) is exemplified in those cases in which the persistent relation and absolute polycythemia is due to an excessive erythroblastic activity of the bone marrow, which appears to be the primary morbid picture in a condition which is characterized by a persistent increase in the viscosity and total volume of the blood, cyanosis, and enlargement of the spleen. The second condition (b) is one in which the erythrocytosis is an effort on the part of the organism to compensate for some difficulty in the oxygenation of the blood and tissues of the body. Thus, erythrocytosis may be looked upon as analogous to a leukocytosis, and in all cases of erythrocytosis there is as much cause for the hyperplasia of the red blood corpuscles as in cases of renal and cardiac disease there is for the heart to become hypertrophied. As conditions inducing the second group may be mentioned residence at high altitudes and chronic cardiac and pulmonary complaints. Weber then goes into the various causes of the polycythemia in cases of erythrocytosis and in those of erythema, and the character of the blood and blood-forming tissue in absolute polycythemia. The condition of erythema is next considered in detail. As regards its pathology and etiology, the various hypotheses as to its being due to a primary disease of the bone marrow, increased durability of the red blood cells, diminished oxygen capacity of the hemoglobin, or possibly to toxic and infectious causes, are discussed, the prevailing theory being that the polycythemia

is due to a "primary" myelopathy; the question of impeded circulation (blood stasis) as a primary cause for the polycythemia has, however, been seriously considered. As regards treatment the various measures advocated are detailed. Venesection, splenectomy, x-rays, and many drugs have been used, most of which have had little or no satisfactory effect. The plentiful use of German "sour milk" or some similar preparation, on account of the effect on the flora of the large intestine, might be worth a trial in some cases, and a lacto-vegetarian diet, or one rendered as poor in iron as possible, has likewise been suggested.

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**Pernicious Anemia and Renal Lesions.**—M. LABBE and E. JOLTRAIN (*Arch. des maladies du cœur, des vaisseaux, et du sang*, 1908, i, 366) note that relations between pernicious anemia and renal lesions have been suggested lately, and report the following case: A man, aged fifty-two years, came under treatment for a grave anemia, weakness, and generalized œdema. The patient grew steadily worse, and died in apparently uremic coma. The examination of the blood showed an intense plastic anemia with myeloid reaction and hyperleukocytosis; some nucleated reds were present and the corpuscular resistance was normal. At autopsy the main lesion present was nephritis with a kidney of the large white type. The factors of dilution of the blood, toxic hemolysis, or a defect in the corpuscular resistance, the author does not think can enter into this case. It is possible, however, that both the renal and blood lesions are the result of some infection or intoxication. At any rate, this association of the two lesions is frequent and should be noted in a condition the cause of which is so often unknown. The diagnosis between Bright's disease and pernicious anemia at times is very difficult, and a careful examination of the blood in all nephritics may help to distinguish the yellowish color of the skin of one condition from that of the other; one should bear in mind the possibility that both conditions may exist as a pathological syndrome in the same individual.

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**Arterial Hypertension with Hyperplasia of the Pituitary and Suprarenals.**—J. PARISOT (*Arch. des maladies du cœur, des vaisseaux, et du sang*, 1908, i, 426) discusses those cases in which there is increased blood pressure and consequent cardiac hypertrophy in the absence of lesions in the kidneys, the condition depending apparently on the hyperplasia of two blood pressure raising organs, the pituitary and the suprarenals. He reports a case in a young girl, aged twenty-two years, who had been perfectly healthy up to a period six months before her death. Then symptoms of amenorrhœa and ovarian trouble began, followed gradually to the time of admission to the hospital by evidences of increasing cardiac hypertrophy, arteriosclerosis, and great hypertension. There were also cerebral disturbances due to increased intracranial pressure. At autopsy the kidneys were perfectly normal, the heart much hypertrophied, while the pituitary and suprarenals showed great hyperplasia. The ovaries showed some cystic degeneration. The known relation of degeneration and atrophic conditions of the ovaries and testicles to hyperplasia of the suprarenals, as pointed out by other authors, leads Parisot to suggest that the ovarian lesion was probably the primary cause of the increased functioning of the suprarenals and

pituitary which led gradually to the cardiac and arterial changes from which the patient died.

**Gastromyorrhœa.**—JULIUS FRIEDENWALD (*Boston Med. and Surg. Jour.*, 1908, lix, 265) observes that the presence of small quantities of mucus in the fasting stomach has been frequently noted. This normally should not exceed 5 cm., and when above 25 cm. Kuttner considers it indicative of the condition of gastromyorrhœa. The diagnosis is, however, justified only when the mucus is constantly present or appears at certain intervals in patients who are unaccustomed to the use and manipulations of the stomach tube. Otherwise the action of the tube itself may account for secretion of mucus. There are two forms of this disease, the intermittent and the continuous. In the first the patient is comparatively well during the intervals between the attacks, which come on, as a rule, suddenly, with severe headache, pain, and vomiting, the latter condition being quite intractable; no food or medicine can be retained, and after a period varying from one to five days, and in one case even up to twelve days, the attack suddenly ceases. In the other type there are no characteristic symptoms and it is usually discovered in examination for other conditions of the stomach, as chronic catarrh, conditions with an absence or diminution of HCl, etc. As regards treatment, lavage seems to be of some service at the beginning of an acute attack, but not later. In the chronic form it is of some help, as is also the free administration of mineral waters. Other symptomatic measures may be used during an attack, and in the interval measures should be employed to correct as far as possible the neurotic tendency, which is marked in some cases. In association with the above abstracted article on the hypersecretion of mucus, the same affection of the intestinal tract is the subject of an article by L. Cheinisse (*Semaine médicale*, 1908, xxviii, 385), on enteromyorrhœa of nervous origin, in which he reviews the literature of the subject and reports some cases in detail. As regards the etiology of this, as in the previous condition, the nervous element seems to play an important part, some patients having also had obstinate constipation of long standing. It is of importance to distinguish this form of the disease with its absence or scantiness of formed elements and excessive amount of thin mucus, the patient experiencing no pain, from those cases of mucous colitis in which the evacuation of mucus often formed and in casts, preceded generally by pain, are the striking symptoms. In the treatment of this disease the nervous condition of the patient must be carefully considered. The bowels must at first be thoroughly cleansed, and after a rest of a few days flushed with mild astringent enemas.

**Comparative Experiments on the Presence of Complement-binding Substances in the Serum and Urine of Syphilitics.**—UDO J. WILE (*Jour. Amer. Med. Assoc.*, 1908, li, 1142). The great amount of work recently done on the blood of syphilitics with the Wassermann reaction successfully has led to a finding of the same complement-binding substances in the milk of syphilitic women, and in a preliminary report Wile and a co-worker have demonstrated the same reaction in the urine of syphilitic patients. In this paper the results of the investigations of 100 cases

in which the serum and urine were tested is given, so that the relative value of each in the diagnosis of syphilis could be compared. Wile concludes as follows: The urine in a large percentage of cases of syphilis contains substances which behave in the same way as the antibodies in the serum of the same cases. These substances seem to appear a little later in the urine than in the serum, and at times are present in one and not in the other, and vice versa. The diagnostic value of the reaction in the urine must for the present be viewed with caution, inasmuch as 2 per cent. of our total number of cases gave a positive reaction in the urine, while the serum in these cases was negative. In both serum and urine these bodies tend to disappear under vigorous antisyphilitic treatment.

**The Serum Diagnosis of Syphilis in Mental Affections.**—G. RAVIAT, M. BRETON, G. PETIT, M. GAYET, CANNAC (*Presse médicale*, 1908, lxxi, 564). The importance of syphilis as an etiological fact in so many cerebral and cord lesions has led the authors to perform the Wassermann test in 400 persons suffering with such disturbances. Of these, 165 gave positive reactions and 235 negative. Of 72 patients with general paralysis, 13 giving a history of lues, there were 93 positive and 7 negative reactions. All the cases in general paralysis and tabes reacted positively. Of the acutely demented cases the reaction was not so common. Thus, in dementia præcox, 26 per cent. were positive; in organic dementia, 30 per cent. positive. In cases of arrested mental development, such as idiots and imbeciles, the positive reactions occurred in from 30 to 34 per cent. In 234 cases with some stigmata of hereditary lues, only about 16 per cent. gave negative reactions, and in many of these there was the possibility of the glandular or ocular manifestations not being luetic. In conclusion, the authors, as a result of these positive and negative tests, wish to note the importance of lues as an etiological factor in general paralysis and tabes, and, to a lesser degree, dementia præcox, organic senile dementia, and finally in epileptics, in which latter there were the fewest positive reactions. In the imbeciles and idiots the importance of lues in their etiology is shown by the frequent positive reactions, which occurred in about one-third of the cases.

## SURGERY.

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**Cancer of the Mouth and Tongue.**—WARREN (*Annals of Surgery*, 1908, xlviii, 481) says that the relation of the lymphatic system to the primary growth is the most important anatomical consideration in operations for

cancer of the mouth and tongue. Persistent chronic inflammatory processes of the mucous membrane predispose to cancer, and should be treated surgically. Cancer of the mouth and tongue is limited locally and to the adjacent lymphatic system. Internal metastases are rare. Microscopic diagnosis is the crucial test in doubtful cases, and should be made at the time of operation. Antisymphilitic treatment is not a sure guide, and should not cause delay in operation. Modern operative treatment involves: preliminary treatment of the mouth; protection of the respiratory tract by drugs, intubation of the pharynx, or laryngotomy, or by position; removal of the primary lesion with a margin of one inch, if possible, of healthy tissue; block dissection of the lymphatic bearing tissues of the anterior cervical triangle, on one or both sides, as a routine measure. A lower mortality may be obtained by the block dissection of the neck as a secondary operation, about two weeks after the excision of the primary disease. The intrabuccal operation is inadequate to reach the entire operative field, and should be supplemented by a dissection of one or both anterior cervical triangles. The ideal operation of the future should contemplate a free exposure of the mouth and anterior cervical triangles as one continuous area with a block dissection of its diseased contents. The mortality varies with the extent of the operation, and is lowest (5 per cent.) with the intrabuccal operation, and highest (30 to 35 per cent.) in the operations involving division or resection of the lower jaw. Death is, as a rule, attributable to shock, sepsis, or bronchopneumonia. In a series of cases taken consecutively from the records of the Massachusetts General Hospital, 112 operations upon cancer of the tongue and mouth resulted in 16 cases free from recurrence over three years after operation (14.2 per cent.) (all supported by pathological examination of the tissue). Of 57 cases of the tongue, 10, or 17.5 per cent., were cured by operation. Local recurrence of the disease occurred more often than recurrence in the lymphatic glands alone. In only one case did recurrence make its appearance at a period of more than three years after operation.

**The Operative Treatment of Gunshot Wounds of the Spinal Cord.**—BRAUN (*Deut. Ztschr. f. Chir.*, 1908, xclv, 115) says that operation is indicated when there is reason to suppose that the bullet (splinters, cicatricial tissue, callus, etc.) in the spinal canal is projecting into the cord or producing an irritating process about the cord; and the functional disturbances, in part at least, can be accounted for by compression or irritation. Except in those cases in which a comminuted fracture or a hemorrhage with threatening infection compels an early operation, the indication, according to our present views, is to delay operation until we can determine the extent to which there will be a spontaneous return of function and until a topical and anatomical diagnosis can be made. The gravity of the cord lesion is the decisive factor. Mild cases with early moderate or rapidly improving symptoms should not be operated on. Missiles have often been fruitlessly searched for and have been falsely localized. The smaller the missile the longer one should wait for a subsidence of the symptoms. Small bullets can often find sufficient room near the cord, and the diagnosis of their presence, when not associated with severe lesions of the cord, may be very difficult or even impossible. Small shot may heal in permanently, in the substance of the cord,

without reaction. The larger the missile or the splinter the greater the probability of finding it quickly and the greater the danger of secondary disturbances from it, as infection or irritation. The operation is indicated in cases with severe cord lesions showing slow improvement or cessation of it, due to intradural or extradural foreign bodies pressing upon or irritating the cord. The fear of the existence of a total transverse lesion does not contra-indicate operation, and one should not wait too long before operating in such cases. The operation should be done under most favorable conditions, upon the basis of a good skiagraph and a careful diagnosis of the segment of the cord involved. Only then could the unquestionable inherent dangers of the operation be successfully avoided. Braun thinks that the osteoplastic methods of doing laminectomy are not advisable, particularly in gunshot wounds of the cord. The raising of such a flap, which includes the laminae, would considerably endanger the cord because of the adherent and probably lacerated dura. Moreover, the danger would be greater from the more or less fractured and splintered canal, which condition was present in many of the cases. After exposing the vertebrae he would first remove the spinous processes, open up the canal by removing an uninvolved lamina, and then would bite away step by step the involved laminae, first with small and then with large gouge forceps. This operation is time consuming, but without danger, and does not shake up the cord, as would the blows upon a chisel. Under aseptic conditions he would close the wound, with the introduction of one or two drains, which could be removed in four days. If infection were present, he would employ the open wound treatment, with drainage and gauze packing.

**A. New Method of Producing Local Anesthesia in the Extremities.**—BIER (*Archiv f. klin. Chir.*, 1908, lxxxvi, 1007) introduced novocain into the circulation for the production of local anesthesia in an old case of tuberculosis of the elbow. By means of an Esmarch bandage applied from the fingers to above the elbow, the blood was pressed out of the limb. Then tourniquets were applied four fingers' breadth above and the same distance below the elbow. The median vein at the elbow was then exposed under Schleich's infiltration method of anesthesia. As in intravenous infusion, a cannula was introduced peripheralward through a slit in the vein and held by a ligature. The vein was then ligated on the cardiac side, and with the usual infusion instrument 10 c.c. of a 0.25 per cent. novocain solution were injected into the vein. The valves in the veins offered only slight resistance to the passage of the fluid throughout the portion of the limb included between the tourniquets. Immediately after the injection was ended the previously very stiff and painful joint could be moved without pain. The resection was then begun. The incision through the skin, muscles, and periosteum was without pain. The lifting of the periosteum was at first complained of, but soon it was not noticed. The extirpation of the capsule, sawing of the bone ends, and excision of the fistulous tracts were likewise painless. That the condition was a very painful one was seen from the loud outcries on the preliminary injections of the Schleich fluid. At the termination of the resection, one-quarter hour after the injection of the novocain solution, the sensation below the peripheral tourniquet was tested. It was absent throughout the whole part, but motion was not. Twenty

minutes after the introduction of the novocain the operation was ended. The peripheral tourniquet was then removed and the central one loosened to such a degree that the arteries were opened but the veins still kept closed. The novocain was thus prevented from entering the general circulation. Then the tourniquet was again tightened, and after completion of the packing of the wound it was completely removed. After seven minutes sensation returned on the flexor surface, and after two minutes more on the extensor surface. The same method was employed with equal success in a necrotomy of the lower two-thirds of the radius.

**The Operative Treatment of Lung Abscess.**—PERTHES (*Archiv f. klin. Chir.*, 1908, lxxxvi, 1054) says that the results obtained from operation for chronic lung abscess are not as good as those from the acute form. Acute and chronic abscess of the lung have much the same relation to each other as recent and old empyemas. While simple pneumotomy in acute abscess of the lung usually heals without fistula, this is not the case with the chronic form. Our treatment in acute cases is well established upon the basis of large numbers of cases, but this is scarcely so of the chronic. The latter is usually a continuation of an acute case. Drainage by expectoration through an opened bronchus is not sufficiently free, and re-accumulation repeatedly occurs, or the abscess is too large to permit collapse of its walls after the evacuation of its contents. The walls become callous, and not rarely new abscesses develop in the neighborhood of the original. It is best in these cases to open and drain the abscess first by a pneumotomy. The removal of the abscess wall should be deferred to a later period, when the general condition of the patient will be improved. The original pneumotomy for the opening of the abscess cavity should be done in two stages. In the first, the ribs should be resected and the visceral and parietal pleuræ attached to each other by sutures under anesthesia. The second stage, carried out a few days later, consists in locating the abscess from the wound by puncture and in opening it without narcosis. The later operation consists in removing the abscess. This is done by extirpation of the whole abscess wall, with the application of the skin and muscle chest flap upon the lung wound.

**A New Treatment for Old Tubercular Sinuses.**—RIDLON and BLANCHARD (*Amer. Jour. Orthop. Surg.*, 1908, vi, 13) report the results in 26 cases, in which Beck's bismuth-vaseline paste was employed for the treatment of old tubercular sinuses. Beck used two mixtures. The first consisted of bismuth subnitrate 1 part, and vaseline 2 parts. These were mixed while boiling, and the mixture was injected into the sinuses for the purpose of obtaining a clearly outlined skiagram of the track of the sinuses. The second mixture differed only slightly from the first, and consisted of bismuth subnitrate, 6 parts; white wax, 1 part; soft paraffin, 1 part; and vaseline, 12 parts. In most of the 26 cases the first mixture was injected and evacuated within twenty-four hours. The second was then injected into the fistula until it would hold no more without painful distention. The temperature of the paste was high enough to give it the consistency of cream. The cases were divided into three groups. In the first, the opening of the fistula healed over in from one to three weeks, and the fistula was cured with the bismuth paste partially retained. In the



second group the results were only partly favorable, owing to the extensive bone destruction, leaving many ramifying sinuses. Injections were made three times a week. In two or three weeks the pus was changed to a transparent viscid fluid, giving assurance that after months of persistent treatment the sinuses may be cured. In the third group, the negative cases, there was extensive bone destruction, with retained sequestræ and ramifying pockets, so deeply and peculiarly situated that the bismuth paste could not be forced into them, and, therefore, the pus could not be displaced from them. The theory offered by the writers for the action of bismuth-vaseline paste, is that: (1) The material acts as a plug forcing and squeezing out the pus; (2) it so completely fills the sinus as to prevent the ingress of germ laden air; and (3) it compresses the unhealthy granulating surfaces and favors a normal healing process. Of the 17 cases of tubercular sinuses at first treated with this injection material, 9 were cured in from seven to thirty-three days, while 7 of the remaining 8 were more or less improved at the end of three months. Four large tubercular abscesses, two psoas and two hip, were opened, evacuated, and filled with the bismuth paste. This was followed by a discharge of transparent serum, which diminished, after three or four days, to 10 or 15 drops a day. This serous discharge remained absolutely sterile and after a few days ceased altogether. There was no rise of temperature or other untoward symptom in either case, and the writers believe that the problem of opening tubercular abscesses and keeping the cavities sterile, has been solved. Six of the cases had been under the tuberculin treatment by the Wright method for one and one-fourth years, with no notable change in either the quality or quantity of the pus discharged from the several sinuses. Two of the 6 sinus cases have since been cured and the other 4 so much improved under the bismuth-paste treatment as to give promise of ultimate cure. The closing of the sinuses does not imply any relaxation of the mechanical and other treatments in cases of progressing tubercular joint disease.

**The Influence of Weight-bearing on the Treatment of Tubercular Hip-joint Disease.**—GIBNEY (*Amer. Jour. Orthop. Surg.*, 1908, 21) says that from 1884 to the present time he has had a large experience with the ambulatory traction hip splint in all of its modifications except those which allow motion at the joint. Yet immobilization has always appealed to him. The late Hugh Owen Thomas claimed the best results from immobilization, with and without the use of the limb, that is, crutches and a high shoe in the more active stages of the disease, and without these aids in the less active stages. Pathologically considered, it would seem that the weight of the body should never be considered as safe until one is assured that all active disease, all exacerbations, have passed. Gibney's clinical experience in the last few years, however, has led him to believe that the danger is a fancied one and not real. He thinks that if the motion of the affected joint is put out of action, the weight of the body in walking may be useful rather than harmful, and he offers the reports of a few cases in corroboration of this view. The first case was one of hip disease of rather acute invasion. There were rather extensive changes in the head and neck, as shown by the x-rays, and deformity. Traction was employed at first, but fixation by a short plaster-of-Paris spica bandage, with use of the limb, was employed

during the greater period of treatment. After about four and one-half years of this treatment the result was almost perfect. Seven other cases were treated in a similar manner, with excellent results, although not a complete cure in all.

**Death following Spinal Anesthesia with Stovaine.**—HARDOUIN (*Arch. gén. d. chir.*, 1908, ii, 115) reports a death in his practice from this method of anesthesia, and the results of a study of 16 fatal cases collected from the literature. There is much difference in opinion among writers who employ stovaine by lumbar injection. Hardouin considers that it is contra-indicated in the aged and the feeble and in children. Even its warm partisans admit the necessity of having ready the material for intravenous infusion of artificial serum, also caffeine and ether, so that the method is absolutely impracticable in emergency surgery outside of a hospital. It should be reserved for those cases in which chloroform is contra-indicated and in those in which local anesthesia is insufficient. While Hardouin recognizes its value in some cases, his study of the subject does not permit him to say that it is without danger. He believes that his case belongs in the list of those for which the method is contra-indicated. Yet he prefers to give up its use rather than expose himself to the danger of overlooking a contra-indication which may be difficult to recognize. He strongly objects to using spinal anesthesia with stovaine unless chloroform or local anesthesia is contra-indicated.

**Two Cases of Stricture of the Prostatic Urethra.**—ANDRE (*Ann. d. mal. d. org. génito-urin.*, 1908, ii, 1041) says that while these strictures have been reported, they are still rare, and further reports are desirable. He records two cases, the only ones he has ever seen, in a large experience in genito-urinary diseases, and these he saw a few days apart. Both occurred in old men, one aged sixty-six years, the other aged seventy-two years, so that some doubt arises as to whether they were not obstructions due to prostatic enlargements. In the first case he was called on account of acute retention. There had been difficulty in urination for several years, and the patient some time previously had been passing on himself from time to time a No. 14 conical bougie, but had not continued to do so. A No. 23 sound passed easily through the anterior urethra, but stopped at the prostate. Digital examination through the rectum showed the prostate to be as large as a mandarin. Thinking that the urethra had deviated because of the hypertrophy of the prostate, various catheters were tried, some soft with a staff, and others metallic with large curve, but all without effect. They became engaged about 2 cm. in the prostate and could progress no farther. Small sounds and filiform bougies were also tried without success. To relieve the retention suprapubic tapping was done morning and evening, for three days. Finally, on the third day, a filiform was passed and tied in position. The next day a No. 10 sound was passed. The size was increased every few days until No. 20 was reached. With all these sounds there could be felt, in passing the prostate, a gripping of the instrument in a hard, fibrous ring, difficult to dilate. Finally, after some months a No. 23 was passed. The patient now urinates very well, and empties the bladder almost completely in spite of the enlarged prostate, and his general condition has improved very much. The patient never sustained any injury in this

region. In the second case the difficulty in urination had been supposed for some years to be due to the enlarged prostate, but the increasing difficulty and pain from passing a No. 13 or 14 catheter suggested a tightening stricture of the posterior urethra. The prostate was much enlarged. Internal urethrotomy was done and a permanent catheter left in for six days. A No. 20 sound was passed afterward, as often as was necessary. After a cure of six months duration the caliber of the urethra again began to decrease and was kept open only with considerable difficulty.

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## THERAPEUTICS.

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**Local Use of Magnesium Sulphate Solution in Erysipelas.**—TUCKER (*Therapeutic Gazette*, 1908, vi, 381) reports excellent results in 19 cases of erysipelas complicating both medical and surgical cases. In 35 uncomplicated, though severe, cases, all recovered within two to seven days, and the pain and usual local discomfort was relieved in a few hours. In the entire series no internal treatment was employed, unless indicated by some complication. He employs a saturated aqueous solution of magnesium sulphate. This is applied on a mask consisting of 15 to 20 thicknesses of ordinary gauze, extending well beyond the area involved. A small opening is left for the nostrils, but none for the eyes. The mask is covered with oiled silk or wax paper and kept constantly wet. The dressing is not to be removed oftener than once every twelve hours, and then only for inspection of the parts. Tucker claims the advantages of this form of treatment over others are as follows: It is easily obtained and easily made into solution; it is non-toxic, inexpensive, clean, and easy to apply; it promptly allays the pain and discomfort; the temperature rapidly falls to normal usually during the second twenty-four hours and remains down; it lessens the liability to serious complications; there is no necessity for internal medication. Tucker has also used this treatment in over 700 cases of various forms of inflammation, and considers it the best form of local treatment for such conditions.

**The Practical Application of the Salt-poor Diet.**—STRAUSS (*Ztschr. f. Phys. und diät. Therap.*, 1908, xix, 14) discusses the best methods of reducing the amount of salt in a mixed diet. This matter is of considerable practical importance, since a salt-poor diet is now recommended in certain cases of nephritis and of heart disease. A similar diet has been used in diabetes insipidus with good results. In epilepsy a salt-poor diet has been an aid in carrying out a long course of bromide treatment. For the proper prescribing of such a diet it is necessary to possess a knowledge of the amount of salt contained in the ordinary articles of

food, both in their natural state and as ordinarily prepared for the table. Strauss presents such comparative lists, and the following examples may point out the practical advantage of such a knowledge: Milk contains 0.15 to 0.18 per cent. of salt; salted butter, 1 per cent.; unsalted butter, 0.02 per cent.; cheese, usually from 1.5 to 2.5 per cent.; eggs, 0.14 per cent.; white of egg, 0.19 per cent.; egg yolk, 0.02 per cent.; and meat, 0.1 per cent. Corn and legumes (except lentils, which contain 0.23 per cent.) contain 0.01 to 0.1 per cent. Most of the other vegetables contain about 0.1 per cent. Spinach (0.21 per cent.) and celery (0.31 per cent.) contain more than the average. Fruit usually contains less than 0.06 per cent. The following partial list shows the importance of methods of cooking. Thus, poached eggs contain 0.5 per cent. of salt, while scrambled eggs and omelets contain from 2.4 to 2.7 per cent. Roast beef contains from 1.9 to 2.8 per cent., and beef stew 3 per cent. White bread contains from 0.48 to 0.7 per cent., and brown bread 0.75 per cent. Cooked cauliflower and mashed potatoes contain about 0.5 per cent., while asparagus contains 2.7 to 3.5 per cent. In general, Strauss states that those articles are to be avoided which need to be cooked with salt in order to be palatable. This means a limitation in meats and meat broths. Since these are usually forbidden in the conditions for which this diet is available, this is not an added hardship. This deficiency in proteid caused by excluding meat preparations is met by the use of proteid foods which need little or no salt in their preparation. Such foods are milk, cheese, and eggs in various forms. Poached eggs and scrambled eggs can be made palatable without salt. Various sauces, made with flour and sweet butter, add to their palatability. The carbohydrates are supplied by bread made without salt, puddings, various forms of pastry, fruit cooked with sugar, etc. Bread is of great importance in a salt-poor diet, because when the amount of meat is limited larger quantities of bread will be taken. Though the unsalted bread has a sweetish taste, it is not unpleasant with unsalted butter or marmalade. Various vegetables may be given, because they introduce variety into the diet and because they form vehicles for flour and especially fat. Strauss does not recommend the salt-poor diet for all cases of nephritis, but only when there is dropsy or a tendency to dropsy. He makes use of a "trial diet" which consists of one-half liter of coffee and milk, one liter of milk, one-fourth liter of a milk soup, 2 eggs, 80 grams of butter, 80 grams of beef, 4 rolls. A normal person should excrete 7 to 9 grams of salt on this diet. This trial diet should be given to the suspected case of nephritis. If there results a considerable discrepancy from the theoretical excretion of salt, it would indicate a tendency to dropsy if it did not already exist. In cases of heart disease a moderate limitation in the amount of salt is generally sufficient. A rigid treatment is necessary only when there is marked degeneration of the kidney resulting from long-standing congestion.

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**Exclusive Milk Diet in the Treatment of Obesity.**—MORITZ (*Münch med. Woch.*, 1908, xxx, 1569) has found an exclusive milk diet extremely effectual in the treatment of obesity. He cites 8 cases, mostly in private practice, which prevented a more careful study of the metabolism. The patients lost from 2.4 to 21 kilograms in from 6 to 81 days. He allows from three to five pints of milk daily in five portions. For breakfast

a pint is given, at 10 A.M. a glass, at noon a pint, at 4 P.M. a glass, and at 7 P.M. another pint. The milk may be given warm or cold, and as much as a pint of water may be added to the daily quota. In order to vary the diet, one of the fermented forms of milk may be given. This method obviates thirst and hunger and possesses another advantage in its low percentage of salt content. Thus, it adds a favorable influence on heart and kidney complications. In Moritz's cases the heart disturbances subsided, the pulse rate became lower, and the pulse tension fell. Some of the cases had constipation, which he treated by simple laxatives. When the weight dropped too rapidly, headache and general depression seemed to occur. The patients should preferably remain quiet while on the diet; this lessens the liability to unfavorable symptoms. He estimates the amount of overweight by the difference between the actual weight and a theoretical normal weight. He says a normal person should weigh as many kilograms as his height in centimeters exceeds 100. Thus, a man 168 cm. in height should normally weigh 68 kilograms. He reckons the caloric value of the food with relation to this theoretical normal weight. In his cases he used 16 to 17 calories per kilogram. Since there are about 16.2 calories in 25 c.c. of milk, one can easily obtain the total quantity of milk required in the individual case by multiplying the weight in kilos by 25.

In the first few days most of the loss in weight is due to loss of water. Careful nitrogen determinations were made in one case, over a period of forty-eight days, in order to estimate a possible loss of body proteid. Moritz found that 88.9 grams of nitrogen were lost during the time. These 88.9 grams of nitrogen represent 555.6 grams of albumin or 2920 grams of muscle. The total loss of weight during this same period was 12,500 grams, the difference presumably being water and fat. Both the loss of proteid and fat furnish additional calories to the body. In this particular case these calories from the body proteids and fats added to the calories contained in the milk taken amounted to 38 to 40 calories per kilo of the normal weight. Von Dapper and von Noorden maintain that the proteid loss can be avoided if the proteid percentage of the diet is raised. Von Dapper says that this loss can be avoided when the proteid of the food forms 30 to 40 per cent. of its total caloric value. The proteid of milk forms only about 20 per cent. of its caloric value. Moritz experimented with the addition of nutrose to the milk and raised the proteid in the food to about 26 per cent. of the total caloric value. This was done in only one case, but in this case the proteid loss increased instead of diminished, as would be theoretically expected. Moritz believes that much useful information can be obtained by further observations with this milk diet. He commends above all its simplicity both for the patient and the physician.

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**Serum Treatment of Epidemic Cerebrospinal Meningitis.**—FLEXNER and JOBLING (*Jour. Exper. Med.*, 1908, i, 141) state that the administration of their antiserum by direct injection into the spinal canal was based upon some observations first made by Flexner. He noticed that normal sera and sterile exudates had a bactericidal effect upon *Diplococcus intracellularis*. Furthermore, he was able to determine a curative action when a prepared antiserum was brought into immediate contact with the focus of infection in guinea-pigs and monkeys infected with the

diplococcus. Flexner and Jobling state that the serum should be injected directly into the spinal canal in order to secure a restraint of growth at the site of infection. They consider this bactericidal action of more importance than some theoretical objections based on the fact that the destruction of the meningococci liberates their endotoxin. There is experimental evidence to show that the antiserum possesses a certain antitoxic value, since it can neutralize the toxic substance of autolysates of the diplococcus. They believe that the serum increases the phagocytic power of the leukocytes or renders the diplococcus more subject to phagocytic digestion. They also think it probable that the phagocytes not only prevent further multiplication of the diplococci, but also detoxicate the endotoxin by reducing it to non-toxic or less toxic compounds. The fact that colloids and even crystalloids are eliminated from the blood into the cerebrospinal fluid very slowly and imperfectly is an additional reason for the intraspinal injection. The serum is obtained from horses which have been inoculated subcutaneously. The process of immunization may take a year or more. Alternate inoculation of living meningococci and autolysates are made at seven-day intervals. They give the following instructions for the use of the serum: (1) The serum should be kept in a refrigerator until it is to be used, when it should be warmed to the body temperature before it is injected. (2) The serum should be injected directly into the spinal canal after the withdrawal of cerebrospinal fluid by lumbar puncture. (3) The quantity of serum for a single injection should not exceed 30 c.c. It is desirable, although not apparently essential, to withdraw from the spinal canal at least as much fluid as the amount of serum to be injected. The injection should be made very slowly, especially when the quantity of cerebrospinal fluid withdrawn is less than the amount of the serum to be injected. (4) The injection should be repeated every twenty-four hours for three or four days or longer. (5) In general, the earlier in the disease the injections are made, the better the results. Therefore, injections should be made when film preparations show intracellular Gram-negative diplococci. If the culture should show later that the disease is not epidemic meningitis, no harm will result from the injection. (6) Although the best results have been obtained when the injections have been made early in the disease, no case should be considered hopeless. It seems useless to employ the serum in the very late cases when chronic hydrocephalus has developed.

The authors give the detailed histories of the cases treated with the serum and discuss the probable effect of the serum in the individual cases. These cases are included in the following analysis.

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**An Analysis of Four Hundred Cases of Epidemic Meningitis Treated with Antimeningitis Serum.**—FLEXNER and JOBLING (*Jour. Exper. Med.*, 1908, v, 690) give the results which were obtained in over 400 cases of epidemic meningitis treated with the antimeningitis serum. These cases occurred in different and widely separated parts of the United States, Canada, and Great Britain. Some of the cases were in small epidemics, while others occurred sporadically. In all of the cases a definite bacteriological diagnosis was made. Under all other forms of treatment the mortality of the disease in the past has been in the height of epidemics in the United States about 75 per cent. The

mortality of the sporadic form has not been considerably lower, and has sometimes been higher. In making up the statistics on which this article is based they have excluded a certain number of cases. They exclude those cases which survive the first injection less than twenty-four hours. They think that it may be accepted as probable that any marked benefit which the serum may be assumed to exert could hardly be effectively manifested before this time. By this ruling they exclude 21 cases as moribund at the time of injection and 12 cases as fulminant. They also exclude 10 other cases which had secondary and intercurrent fatal complications, or which were chronically moribund, by which term is meant cases which were palpably dying at the time of the first injection, though they survived that first injection longer than twenty-four hours. Excluding these cases, there remain 393 cases; of these, 295 recovered, or 75 per cent. The best results were obtained in cases between five and ten years in age. At that age the mortality was only 11.4 per cent. In infants under one year the prognosis has been very bad, but there were 50 per cent. recoveries in 22 such cases of this series. Some discrepancy as to the higher mortality after twenty years of age exists, but there was not enough evidence to consider the prognosis worse at this age. Robb, of Belfast, treated 21 such cases. Of these, 18 recovered. Of the 3 cases that died, 2 were fulminant.

The histories of 361 cases were sufficiently accurate to enable the authors to approximate the period of the disease in which the first injection was made. The cases were nearly equally divided into three classes. The first class, in which the first injection was made in the first three days, gave a mortality of 16.5 per cent. The second class was injected from the fourth to the seventh day, and gave a mortality of 23.8 per cent. The third class, which includes all the cases injected after seven days, gave a mortality of 35 per cent. This shows that the earlier the injection is made the more favorable the prognosis. This is by no means an absolute rule, since there were many notable exceptions. These exceptions may be explained by individual factors of both patient and organism. The effects produced upon the meningococci in the spinal exudate were very striking. Very soon after the serum injections the diplococci tend to be greatly reduced in number, to disappear from the fluid part of the exudate, and to become wholly intracellular. They also present certain changes of appearance, a swelling and fragmentation, and are apt to stain irregularly. They also lose their viability in cultures. These changes may be due to some restriction of multiplying of the bacteria and to the greater phagocytosis of the leukocytes. Grossly, the spinal exudate loses its turbidity, at times very rapidly. Even distinctly purulent exudates cleared up entirely. Leukocyte counts made before and at regular intervals after the injections showed, in favorable cases going on to recovery, a fall in the number of the leukocytes in the circulating blood, which was often very rapid and even critical in character.

## PEDIATRICS.

UNDER THE CHARGE OF

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**Pyopericarditis in Children under Twelve Years of Age.**—F. J. POYNTON (*Brit. Med. Jour.*, 1908, ii, 365) has studied 100 cases of pyopericarditis. Of these, 66 cases were less than three years old, 17 between three and four; males and females were affected alike. All of them had pulmonary disease as well, 60 having empyema, 40 pneumonia or acute pleurisy; a few also had acute pulmonary tuberculosis. Predisposing causes were measles, whooping-cough, and influenza; the exciting cause always the pneumococcus. From a pathological standpoint some had only a few flakes of fibrinopurulent exudate and a small amount of slightly turbid fluid; others had a fibrinoplastic exudate, similar to but softer than that in rheumatism; others had a large amount of creamy pus, and in the greater number a remarkable thickening of the pericardium was found with some inspissated pus and partial organization of the exudate. The pericarditis arises usually independently of the pleurisy by a simultaneous infection or secondary blood infection, and but rarely by direct continuity. In only 6 cases was the diagnosis confidently made. The difficulty of the diagnosis is due to the following: the pericardial friction exists but rarely; the patients are usually very young; pulmonary disease, such as pneumonia, pleurisy, or empyema, which may even be bilateral, always co-exists; there is no endocarditis; suppurative conditions in other parts of the body—meningitis, peritonitis—may also be present. An acute course was observed in 20 of the patients, in 50 a subacute, while the remainder ran a chronic course. In the first class the duration was about six weeks, in the last six months or longer. In the first class the disease usually began abruptly, in the second with cough, pleural pain, and wasting, in the third with gradual failure of health, strength, and wasting. The most important signs are progressive muffling of the heart sounds, enlargement of the cardiac area, dulness over the pericardium, pear-shaped outline of a distended pericardium, abrupt transition from dulness of fluid to resonance of lung tissue, and a wavy and diffuse pulsation to left of the sternum. The differential diagnosis from rheumatic pericarditis and the treatment are discussed. The latter must be surgical, and even then the disease is almost invariably fatal.

**The Reappearance of a Cutaneous Reaction, which had already Disappeared, during a Scarlet-fever Infection.**—P. HEIM and M. K. JOHN (*Wien. med. Woch.*, 1908, lviii, 1831) report the case of a girl, aged four years, in whom von Pirquet's cutaneous reaction appeared in a most decided manner; the reaction disappeared at the usual time and was followed by four tuberculin injections for the purpose of treatment. Three days after the last injection, one month after the cutaneous reaction, the child broke out with the rash of scarlet fever and simul-



taneously with this the tuberculin papules reappeared; just at the time of the test there were three papules, and they appeared at exactly the same points. A little later at the points of the cutaneous injections, the dosage of which was extremely small, a local reaction also appeared at three places; this consisted of intense redness and infiltration, particularly at the last point of injection. The authors explain this in the following manner: The tuberculysins in the tuberculous child are attached originally to cells; at the onset of the scarlet fever they entered the circulatory stream at the same time as the scarlet fever antibodies; they dissolved the remains of the bacilli deposited in the skin and thus produced the second reaction.

**Pathogenesis of Whooping-cough.**—The publications of Bordet and Gengou concerning the etiology of whooping-cough led C. FRAENKEL to make a series of observations (*Munch. med. Woch.*, 1908, lv, 1683). The sputum of 38 patients was examined, but from only 8 of these could the characteristic organism be cultivated. All the positive cases were in the very beginning of the affection. The organism grew best on media containing considerable human blood. The bacillus is small in size, non-motile, does not stain after Gram stains in toto and quite evenly, and has a definite form even after a number of recultivations. It was obtained from all the early cases of whooping-cough. When pure cultures were injected into monkeys, and particularly when they were made to breathe air containing them, they developed a typical whooping-cough which lasted from eight to ten days; there was no expectoration. Inasmuch as the "Complementablenkung" was negative in four out of five tests, the agglutination test uncertain, and the organisms found in two children absolutely free from whooping-cough, Fraenkel feels that the position of this organism as the cause of whooping-cough is not firmly established; personally, however, he feels that the bacillus stands in some relation to the disease.

**Treatment of Scarlet Fever.**—K. OPPENHEIMER (*Munch. med. Woch.*, 1908, iv, 1691) discusses the treatment of scarlet fever with particular reference to baths and diet. He disagrees with the majority of the German authors, agreeing rather with French and American observers in regard to baths and cold sponging; he does not employ them unless the nervous system is affected. He considers their influence dangerous for the heart, and, more particularly through the possibility of taking cold, for the kidneys. Cold water, especially if applied in the form of packs, is almost certain to chill the kidneys and lead to nephritis. In the first stage of the illness his treatment is purely expectant; rest with plenty of water is probably all the child requires during this time; if the child does not wish to eat or drink he does not force food, but considers the rest more important. As soon as the child evinces some appetite milk is given, also diluted tea; later in the disease any food usually given a child is allowed, with the exception of meat, eggs, and their products. He emphasizes that none of the foods must be salted too much. He keeps his patients in bed for from five to six weeks; in the sixth week he permits warm bathing, using a 1 per cent. corrosive sublimate solution for the body. He has never seen a single kidney complication during the last eighteen years, although he has treated in that time more than 150 cases.

**Epidemic Infantile Paralysis.**—M. ALLEN STARR (*Jour. Amer. Med. Assoc.*, 1908, ii, 111) discusses the epidemic of acute anterior poliomyelitis occurring in New York and vicinity during the year 1907, in which over 2000 cases were observed. The epidemic began in May and lasted until December, being at its height during August and September. The mortality was 6 to 7 per cent. The summer was hot, but not unusually so; it was unusually dry, however. The onset of the disease was uniformly accompanied by brisk fever, vomiting, malaise, sweating, severe pains in limbs and back, rigidity of spine, and in a few cases retraction of head; diarrhoea lasted for a few days, and delirium began often about the second day. The paralysis was usually discovered about the third or fourth day. In the vast majority of cases the legs were chiefly affected, in some the arms as well, in some even the muscles of the back, abdomen, neck, face, and eye. True infantile hemiplegia, poliomyelitis with bulbar paralysis, poliomyelitis with polio-encephalitis of Wernicke, and the ordinarily recognized type of poliomyelitis were observed. Retention of urine and incontinence lasting for some days were observed, but in no case did either become permanent. Death was due to respiratory paralysis or heart failure, and not to the febrile affection. The paralysis was always flaccid, with rapidly following atrophy in the muscles and a rapid loss of faradic contractility. Pain in the affected parts was very common and frequently persisted. Many cases recovered absolutely; most of them improved very much. Bacteriological examination of the spinal fluid and of the blood, as well as serodiagnostic experiments were without result. The treatment consisted in dry-cupping or ice-bags in the early stage of the disease to relieve congestion; the fever could be kept down with sponging, or with coal-tar remedies, in suitable doses, with or without Dover's powder. To keep the patient quiet a purge should be given and the diet consist of milk. Urotropin is advised until the fever subsides because of its antiseptic properties. After the acute stage is over, strychnine, massage, and galvanism should be resorted to. Deformities should be prevented from the beginning of the condition.

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**Skiagraphy of the Newborn.**—VAILLANT and BOUCHACOURT (*Ann. d. hygiène publique et de médecine légale*, 1908, ix, 65) have made a number of skiagraphic studies to determine whether it is possible to tell whether a dead child was dead at birth, whether it died shortly after, or some time after birth—with the following conclusions: (1) In children who have not lived at all no organs are visible on the skiagraph. (2) In children who made a few respirations the stomach alone is visible; the greater the number of respirations the clearer and larger is the picture of this organ; from the size of a small pea it becomes the size of a large bean. (3) In children who lived from one to fourteen hours the stomach picture is still clearer and larger; the intestine also became visible in the skiagraph. (4) In children who have lived several days without nourishment, more of the abdominal viscera become visible, and the lungs, which have not been permeable to the x-rays until this moment, become visible in the picture; the liver becomes sharply outlined, as well as the shadow of the heart, although the latter is not always so clear. (5) In children who have been fed for several days all the organs are more visible, and the gases contained in the intestines produce a better picture of the intestinal loops.

## OBSTETRICS.

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 UNDER THE CHARGE OF

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**Rupture of the Uterus.**—HARTMANN (*Ztschr. f. Geburtshilfe und Gynäkologie*, 1908, 62) contributes a paper upon this subject, reporting four cases. The first was a multipara, whose child died during labor, and was delivered by craniotomy. When an effort was made to remove the placenta, a tear in the uterus was found giving access to the intestine. As there was no hemorrhage, and the patient's general condition was good when admitted to the hospital, no interference was practised, and she was treated entirely by the expectant method, with absolute rest and ice-bag upon the abdomen. She died on the fifth day from peritonitis, which developed so completely and suddenly that operation after its appearance was impossible. Autopsy showed a ruptured uterus with a bruised condition of the bladder wall, which was becoming gangrenous. The second patient had been delivered by embryotomy in a previous pregnancy. She had a contracted pelvis, and pubiotomy was proposed, but refused by the patient and her husband. Her suffering became so extreme that she consented to any operation, when her pain suddenly ceased and the temperature rose several degrees. On examination, rupture of the uterus was recognized. Abdominal section revealed a transverse tear above the cervix, extending widely into the right parametrium. The edges of the tear were not clean, showing that infection was present. The uterus was extirpated and the tissues brought together as well as possible. Gauze packing was introduced, which was brought down through the vagina, and the vaginal wound was closed. The patient suffered shock on the evening of the operation, and had considerable abdominal distention during convalescence. The tissues on the right side of the uterus became infected by *Bacillus coli communis*; pus formed and was evacuated above Poupert's ligament. The patient finally recovered.

In Case III it was determined to open the pelvis and then wait for spontaneous labor. As the head entered the upper pelvis, labor was proceeding well, no operation was done, when, without warning, a moderate hemorrhage occurred from the vagina. The child's heart sounds immediately fell to 100, then to 80, and then ceased. The mother complained of no pain and had a normal pulse of 70. Smaller foetal parts could be felt at the umbilicus. The child was delivered with forceps, with the occiput posteriorly, but an effort to deliver the placenta failed without the introduction of the hand. It was then observed that the upper portion of the uterus was torn completely across, and that coils of intestine were lying in the uterine cavity. The uterus was then removed through the vagina. The patient made an uninterrupted recovery without complications. This patient had previously been delivered by Cesarean section by the transverse incision of Fritsch. Rupture of the uterus occurred in this scar. Microscopic examination of the uterine tissues at the point

of rupture showed that after the original operation the different layers of the uterus had not accurately united. In some portions only the serous covering was joined; a very thin sheet of muscular tissue accompanied the serous covering at these points.

The fourth case was a multipara, who had been delivered by craniotomy, and who also had had spontaneous births. The patient was brought to the hospital in a wagon, having been delivered by a physician by forceps, after version had failed. He had diagnosed rupture of the uterus after delivery. A laceration in the anterior portion of the vagina and cervix, extending into the uterus, could be recognized. The uterus was removed through the vagina and an ovarian cyst was found upon the right side, which was also removed. There had been free hemorrhage into the abdomen and a collection of blood upon the left side in the broad ligament. The bladder was not wounded. The patient made a tedious recovery. Microscopic examination of the tissues of this uterus showed degeneration of its muscular fiber.

Hartmann has collected 18 cases of rupture of the uterus in the scar of a previous Cesarean section. In some of these the placenta was attached at the point of rupture, and in others the histories stated that involution proceeded with great rapidity. These cases seem also peculiar in that the patient complained of very little pain at the time of rupture, and seemed much less disturbed than in cases in which rupture occurred without section. It cannot be ascertained that any one suture material is more unreliable than any other in this regard; in some of these the muscle had been closed by silk, in others by catgut. As regards the treatment of rupture of the uterus by vaginal extirpation, Hartmann has collected 29 cases, with a percentage of recovery of 51.7 and mortality of 48.3. Eversmann's collection of 71 cases, treated by use of the tampon, shows a percentage of recovery of 59 and a mortality of 41. Hartmann considers vaginal extirpation of the ruptured uterus an especially valuable operation. When rupture occurs in general practice, he would have the attending physician, if possible, remove the child and tampon the uterus and vagina. This should control the hemorrhage. He would then have the patient transferred, as soon as possible, to the nearest hospital. In cases in which the child cannot be safely delivered through the vagina, he would remove it by abdominal section, removing the uterus by vaginal section.

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**The Supports of the Pelvic Viscera.**—PARAMORE (*Jour. Obst. and Gynec. British Empire*, September, 1908) contributes a paper, which he has enlarged somewhat from his previous writings upon this subject. He believes that variations in abdominal pressure are of the greatest importance in determining prolapse of the pelvic viscera. He also believes that firm contraction of the levator ani muscle is of great importance in preventing the prolapse or expulsion of pelvic contents. He draws attention to the clinical value of rest in bed in preventing prolapse.

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**Purulent Infection of the Uterus by Bacillus Coli Communis.**—WHITEFORD (*Jour. Obst. and Gynec. British Empire*, September, 1908) describes the case of a patient who had an apparently spontaneous labor, followed, three weeks afterward, by a chill with pain in the abdomen. There was a central abdominal tumor, slightly tender, very tym-

panitic, midway between the pelvis and the umbilicus. The tumor was increasing in size. On dilating the cervix a quantity of very foul pus and gas escaped. The pus was dark brown in color, and the odor suggestive of infection with *Bacillus coli communis*. Under repeated irrigation with peroxide of hydrogen, the odor disappeared, but the patient became rapidly worse, and died, with extensive alterations in the blood. *Bacillus coli communis* was found in great abundance in the tissues. The examination of the uterus showed that there was an infected fibroid in the body of the uterus, and that the cervix was infected and occluded with masses of pus.

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**Cancer of the Breast Complicating Pregnancy.**—CHEYNE (*Brit. Med. Jour.*, October 3, 1908) contributes a paper upon cancer of the breast and its treatment, in which he states that in comparatively young women during pregnancy or lactation diffuse carcinoma is occasionally seen, and that it grows so rapidly that it resembles subacute mastitis. The skin becomes infiltrated and swollen, and the glands in the axilla are usually involved in an early stage of the disease. These cases proceed so rapidly that surgical treatment is usually of little avail when the patient comes under observation.

[The reviewer can confirm this observation by a recent case in which, in a second pregnancy, a diffuse and highly malignant carcinoma developed from the site of a small tumor removed after the first pregnancy. The physical appearances were those of diffuse mastitis, and the patient, a convert to Christian Science, would not permit interference of any sort. Finally, her pain became so great that surgical aid was sought, and the fluctuating portion of the breast opened under ether; straw-colored fluid escaped, and pieces of tissue were removed for examination. This was found to be encephaloid carcinoma of the most violent type. The patient succumbed from the disease within a few weeks.]

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## GYNECOLOGY.

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UNDER THE CHARGE OF

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**The Epithelium in the Mature Uterus.**—L. MANDL (*Zentralbl. f. Gynäk.*, 1908, xxxii, 425) concludes from the results of his histological studies that the epithelium of the endometrium is not always ciliated, and that when cilia are present there are nevertheless here and there areas in which the epithelium is nonciliated. In animals the periods in which the epithelium is ciliated are of very short duration. Among the ciliated epithelial cells of the Fallopian tubes there are numerous nonciliated secretory cells. At such times, as the uterine epithelial cells normally ciliated are devoid of cilia, they seem to exercise a secretory function.

**The Significance of Pain in Pelvic Disease.**—EMIL NOVAK (*Amer. Jour. Obst.*, 1908, lvii, 473) suggests that while it is true that a careful physical examination is of the first importance in the diagnosis of pelvic disorders, yet a consideration of the character and distribution of the pelvic pain will often yield interesting and suggestive information, although the limitations of such observations from the standpoint of diagnosis are evident. The good surgeon will endeavor, as far as possible, to ascertain the exact nature of the disease before resorting to operation, and will not rest content with merely deciding as to the advisability or inadvisability of operation. The pain of pelvic visceral disease is, in a general way, governed by the same laws which apply to the causation of pain in the other abdominal viscera. One of the dangers of neglect of pelvic disease is the possibility of the development of a condition of neurasthenia, with a diffusion of pain to other parts of the body, and the appearance of other more or less characteristic symptoms of this condition. One of the reasons for the continuance of unpleasant symptoms after operative treatment of pelvic lesions, is the persistence of the neurasthenia which is frequently a complicating factor in such cases. Hysteria, as it manifests itself by pelvic symptoms, presents the same characteristics which distinguish it as it appears in the other parts of the body. The removal of normal ovaries for conditions of pelvic pain is founded upon an erroneous and obsolete conception of the mechanism of such pain, and modern surgery has condemned such a procedure as unjustifiable from a theoretical point of view, and useless from the standpoint of clinical experience. The so-called fibrocystic ovaries are frequently found in women who enjoy perfect health, and hence great caution is necessary in attributing pelvic pain to such organs. If operative treatment be resorted to at all, it should be conservative rather than radical. The gynecologist must learn to look upon pain as the resultant of two factors, the lesion and the patient, and in order to arrive at an intelligent appreciation of the true significance of pelvic pain he must study both these factors with equal fidelity.

**The Treatment of Cancer of the Female Genital Organs.**—J. L. FAURE (*An. de gyn. et d'obst.*, 1908, v, 335) in a report of his work compares the different surgical operations for cancer of the cervix and greatly prefers the broad abdominal operation, following practically the operation known as Wertheim's, which was planned by Emil Ries, of Chicago. Faure considers isolation of the ureters in the broad ligament a very important essential, and removal of any enlarged glands as well as the aggregation of glands at the iliac bifurcation important, although opposed to attempts at removal of all pelvic lymph glands and all the connective tissue between the uterus and the pelvic wall.

**Ventrosuspension an Unsafe Operation for Posterior Displacement of the Uterus during the Child-bearing Age.**—E. B. CRAGIN (*Surg., Gyn., and Obst.*, 1908, vii, 45) says the forms of dystocia after too firm attachment, which are most commonly noted, are: (1) A malpresentation of the child, especially a transverse presentation. This transverse presentation was noted in 15 of the 21 cases of Cesarean section for this condition collected by Lynch, and occurred in all 5 of the cases operated on by Craigin and here reported. (2) An ineffectual labor with cervix un-

dilated and high up. This high position of the cervix is noted in most of the cases demanding Cesarean section, and was present in all of his cases. (3) An unobstructed labor, the obstruction being produced by the thickened anterior uterine wall. Cragin insists that ventrosuspension is not safe in child-bearing women, as it may become a fixation instead of a suspension in one or the other of the following ways: The area of adhesion between the uterine fundus and the abdominal wall may be broader than expected, and the resulting band be too firm to allow uterine mobility. Infection of the abdominal wound may fix the fundus and anterior uterine wall firmly to the abdominal wall. A ventrosuspension, which allows a normal delivery in the first pregnancy following operation, may subsequently become a ventrofixation and produce dystocia so marked as positively to indicate Cesarean section in the second post-operative pregnancy. Cragin reports briefly histories of 5 Cesarean sections he has done as a result of these operations.

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**The Supports in Chief of the Female Pelvic Viscera.**—R. H. PARAMORE (*Jour. Obst. and Gyn., Brit. Emp.*, 1908, xiii, 391) has a carefully prepared article on this subject, and seeks to prove that the pelvic floor is the structure chiefly concerned in holding these organs in proper position. Paramore insists that it is evident that the pelvic viscera are maintained in their position by two sets of forces: one acting from above and pinning, so to speak, the viscera in their places and known as intra-abdominal pressure. The other acts from below, supports the viscera, and prevents their being displaced by any excessive force from above. These two forces, therefore, vary directly with each other; increase of one produces reflexly an increase of the other. This mechanism is under nervous control, which determines any desired end (coughing, defecation, etc.). The force from below is principally supplied by the levator ani and is the essential element in maintaining the normal visceral position. When the pelvic floor is inhibited during defecation, the visceral connective tissue is capable of supporting the viscera temporarily, but is not capable of more than this. When the muscle has become insufficient this connective tissue is unable to maintain the viscera in position.

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**The Pathology and Operative Treatment of Displacements of the Pelvic Viscera.**—W. E. FOTHERGILL (*Jour. Obst. and Gyn., Brit. Emp.*, 1908, xiii, 410) has written extensively and dogmatically upon the pathology and operative treatment of displacement of the pelvic viscera, his recommendations being based upon his conception of the supports of the pelvic viscera as portrayed in his paper in the same journal in January, 1908. He regards classical prolapse of the pelvic viscera (descent of the uterus and its appendages with the bladder, the urethra, and the vagina) as being due to prolongation of the perivascular connective tissue, in the base of the broad ligaments, which extends laterally up to the internal iliac arteries, and that such elongation gives rise to a relaxation that can never be removed. Fothergill, therefore, thinks that surgical treatment is necessarily limited to plastic surgery of the vagina, the perineum, and the cervix uteri, plus ventrofixation. He believes that a part only of the elongation mentioned may exist, which would cause descent of the bladder and the anterior vaginal wall. In some

instances descent of the posterior wall of that canal may also result. In cases of relaxation, as just mentioned, only the lower portion of the mass supporting the uterus is affected, the upper part preserving its function, and the treatment being only plastic surgical procedures. Again, Fothergill regards retroversion or retroflexion of the uterus as being due to the same character of elongation and resulting relaxation occurring in the upper part of the pelvic viscera. When surgical treatment is needed he recommends Alexander's operation when the uterus is movable, and if adhesions or diseased appendages exist, laparotomy, with appropriate treatment of these complications, and Webster's round ligament operation. Apparently no instance of unusual elongation of the uterus with recurrence of prolapse has been noted by him, although others occasionally find them.

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## DERMATOLOGY.

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**The von Pirquet Cutaneous Tuberculin Inoculation.**—KÖNIG (*Archiv f. Dermat. u. Syphilis*, 1908, lxxxix, Heft 3), who inoculated 20 patients with lupus with the old tuberculin according to the method of von Pirquet, obtained reactions varying from the mildest erythema with a scarcely demonstrable infiltration to deep subcutaneous, extremely painful nodules with lymphangitis. All these disappeared, some quickly, some slowly, with scaling and pigmentation. In one case, in which, in addition to an extensive lupus, there were clear signs of pulmonary disease, a general reaction occurred accompanied by severe headache, vomiting, and chills. In 2 cases a conjunctivitis followed the inoculations. The strength of the reaction in the sound skin appeared to depend very much upon the severity of the lupus, those with extensive disease showing a much stronger reaction than those in whom a small area was affected. König believes, from his clinical experience with these inoculations, and from histological study of the lesions resulting from them, that they may be employed, not only for diagnostic purposes, but therapeutically. As to whether the lesions produced by these inoculations are actually tuberculous he does not venture to give a positive opinion, but he inclines to the view that they are non-tuberculous.

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**Kraurosis Vulvæ.**—THIBIERGE (*Ann. de dermat. et de syphil.*, 1908, No. 1), in a recent clinical study of this interesting and but little understood affection of the female genitalia, finds nothing to support the belief that it may follow leukoplakia of the vulva. The distressing itching



which sometimes accompanies the affection he regards as a mere coincidental symptom and not as a necessary part of it. He is inclined to believe that the disease is present to a greater or less degree in all elderly or old women, and is not dependent upon local causes, such as blenorrhœa, sexual excess, or syphilis. He concludes his study as follows: Kraurosis vulvæ, characterized at its acme by a greater or less constriction of the vulvar orifice, by atrophy and a peculiar smoothness of the integuments of the vulva with loss of their elasticity, is preceded by a longer or shorter period during which smoothness and atrophy of the vulvar mucous membrane exist without appreciable contraction of the vaginal orifice. It is the result of the involution of the tissues about the orifice of the vulva, and is connected with the suppression of the function of the ovaries.

**Dermolysis.**—C. J. WHITE (*Jour. Cut. Dis.*, July, 1908), under the above title, reports a case of a hitherto undescribed affection of the skin. The disease, which occurred in a Russian, aged twenty-five years, was characterized by an eruption of cherry-colored papules about the size of a pea limited to the elbows and suprapatellar regions of the thighs. The lesions after a time flattened out or were depressed in the centre, became softer than the new ones, and changed to a muddy-white color. Histologically there were noted "conspicuous epidermal changes; endarteritis; perivascular, perifollicular, and periglandular lymphocytic infiltration; basophilic collagen; collastin, general diminution of collagen and elastin; and, lastly, gradual disappearance of all these structures focally." White has been unable to find any similar condition reported in literature.

**Further Experience with the White and Blue Light of the Quartz Lamp.**—KROMAYER (*Jour. Cut. Dis.*, June, 1908) finds that the undesirably strong superficial action of the quartz lamp may be obviated by the addition of a solution of methylene blue to the water-bath of the lamp. He believes that the light from this lamp is more penetrating than that from the Finsen apparatus, although he admits that other experimenters have not confirmed this. This light has been successfully employed in the treatment of lupus vulgaris, lupus erythematosus, chancreoid, telangiectasis, nævus vascularis, acne rosacea, acne vulgaris, furunculosis, folliculitis barbæ, folliculitis decalvans, eczema, psoriasis, alopecia areata, and ulcer cruris. In lupus vulgaris, vascular nevus, and alopecia this treatment succeeds better than any other yet employed.

SCHMIDT (*Dermat. Zeit.*, April, 1908), who has treated 20 cases of lupus vulgaris with the Kromayer quartz lamp, does not regard it as an efficient substitute for the Finsen apparatus. While absorption of a great part of the lupus tissue may be produced by the light, it soon loses its efficiency, leaving lupus nodules still present. He does not find that the use of methylene blue solution prevents the undesirable superficial necrosis which frequently follows the use of the lamp.

**A Vacciniform Drug Eruption.**—VÖRNER (*Dermat. Zeit.*, 1908, xv, Heft 6) reports a case of vaccine-like eruption following the use of antipyrine and salicylic acid. The patient was a man, aged sixty-three years, who suffered from a right-sided thoracic zoster, for which he was given

0.5 gram each of antipyrine and salicylic acid three times a day. After taking the fourth powder the patient experienced marked itching, which lasted but a short time, and was followed by a more or less general eruption of discrete vesicles the size of a hemp seed to a lentil, many of which showed a central umbilication; there was no fever nor were there any subjective symptoms.

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**A New Method of Treating Lupus Erythematosus.**—HARTIGAN (*Brit. Jour. Dermat.*, March, 1908), at a meeting of the Dermatological Section of the Royal Society of Medicine, exhibited 5 cases of erythematous lupus which he had treated by applications of a 2 per cent. solution of zinc or copper sulphate. The cases were of the circumscribed variety, presenting the sebaceous and telangiectatic type, and had lasted from fifteen months to twelve years. In one of the cases the eruption had entirely disappeared, while in the remaining 4 but few traces of the disease were left. Prompter and more satisfactory results had been obtained by this treatment than by any other.

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**Albuminuria in Scabies.**—NICHOLAS and JAMBON (*Ann. de dermat. et de syphil.*, 1908, No. 2), in a series of 100 cases of patients with scabies, found albuminuria sixteen times. From their study of the literature and from their own observations they conclude that scabies is frequently accompanied by albuminuria, which in its appearance, duration, and disappearance is essentially dependent upon the cutaneous lesions which have given rise to it. Besides the physiological and medicamentous albuminurias, and the albuminuria due to previous Bright's disease, which one may meet in scabies, there is undoubtedly a true albuminuria arising from the evolution of the acarus in the skin. This scabious albuminuria may present itself under two clinical types: (1) Simple, scabious albuminuria, so called without any subjective or objective symptoms, a chance clinical finding, disappearing rapidly after treatment of the scabies, due perhaps to a slight nephritis; (2) true scabious nephritis, with a more or less complete train of the classical symptoms of acute, subacute or chronic nephritis, disappearing with the scabies, or persisting after the cure of the dermatosis. The albuminuria of scabies does not seem to be due to any single cause nor to arise from the single lesion. Sometimes it is a true toxic nephritis, more or less marked and profound; sometimes it arises from the cutaneous irritation alone, being due to reflex modification of the renal circulation or of the functions of the renal epithelium.

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**Radiotherapy in the Treatment of Acne Keloid.**—KIENBÖCK (*Archiv f. Dermat. u. Syphilis*, 1908, xc, Heft 3) reports 4 cases of that very disfiguring and obstinate affection, acne keloid (dermatitis papillaris capillitii of Kaposi) successfully treated by means of the x-rays. Kienböck finds that radiotherapy produces prompt healing even in cases which have lasted many years; in some instances a single sitting may be sufficient to bring about the disappearance of the disease. He advises the use of moderate or large doses.

## HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

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**Vaccination against Typhoid Fever, Cholera, and Pest**—It will be remembered that Wright some years ago introduced vaccination against typhoid fever in the British Army. At the outbreak of the Boer war a considerable number of troops had been vaccinated, and it was hoped that the medical record of that campaign would supply definite information concerning the value of this prophylactic measure. But there were so many disturbing factors influencing the health of the troops and the hospital records, that this hope was not realized. At the close of the South African War vaccination against typhoid fever was discontinued among British soldiers, but later it was taken up again and referred to a commission. LEISHMAN (*Berichte über den XIV Internationalen Kongress f. Hygiene und Dermographie*, ii, 536) has made a preliminary report upon the work and observations of this commission. The vaccine consists of cultures of the typhoid bacillus in meat and broth. These are sterilized, when from twenty-four to forty-eight hours old, at a temperature of 53°, maintained for one hour. The strains used are old, and are possessed of but slight virulence. These sterilized cultures are preserved by the addition of 0.25 per cent. of lysol, and are standardized by an enumeration of the number of bacteria in a given volume of the vaccine. When possible two inoculations are made, the first of 500,000,000, and the second of 1,000,000,000 bacteria, with an interval of ten days. This means, as a rule, 0.5 c.c. for the first and 1 c.c. for the second injection. The site of the injection is either the pectoral region or the outer surface of the upper arm at the insertion of the deltoid. The inoculations are made in the afternoon, and as a rule those treated are returned to duty on the second day afterward. The results of these inoculations in seven large Indian stations during the six months from January 1 to June 30, 1907, are shown in the following table:

	Mean strength.	Cases.	Deaths.	Incidence per 1000.	Mortality per 1000.
Non-inoculated . . . . .	8113	173	42	21.32	5.18
Inoculated . . . . .	2207	15	3	6.80	1.36

MUSEHOLD (*Ibid.*, 545) reports upon typhoid fever vaccination in the German army. The German vaccine is prepared by adding a normal loop (2 mg.) to each 0.5 c.c. of normal salt solution, and this is sterilized at 60°. Three inoculations are made. At first these consisted of 0.5, 1, and 1.5 c.c. of the vaccine, or 1, 2, and 3 loopfuls of the agar culture, but the reactions that followed these treatments were in some instances so serious that the dose was diminished and those now given are 0.4, 0.8, and 1.2 c.c.

The symptoms that follow these inoculations are fairly uniform. Within a few hours there is a chill, followed by fever and vomiting.

The temperature may go as high as  $41^{\circ}$ , though generally not more than  $40^{\circ}$ , and this is accompanied by albuminuria and cylindruria. The use of alcohol following the inoculation is forbidden, as it has been found to intensify and prolong the symptoms. Among more than 8000 vaccinated no lasting harm has been observed. Only those who are willing to do so are submitted to these preventive inoculations. The results of these inoculations seem to be beneficial, as shown by both the morbidity and mortality reports. The number of cases per thousand among the inoculated is 98.4. The beneficial effect on the course of the disease is shown by dividing the cases into (1) the fatal, (2) the severe, (3) the moderate, and (4) the light, such grouping showing the following:

In the inoculated per thousand . . . . .	3.3 : 8.9 : 13.2 : 25.5
Or as . . . . .	1 : 2.7 : 4.0 : 7.7
In the uninoculated per thousand . . . . .	12.6 : 25.4 : 24.4 : 36.2
Or as . . . . .	1 : 2.0 : 1.9 : 2.9

STRONG (*Ibid.*, 1085) finds that vaccination with dead pest bacilli or with bacillary extracts gives practically no immunity in the lower animals, and he is using in Manila a living non-virulent culture. In experimental animals these inoculations induce a fair degree of immunity, and in a small epidemic the deaths among the inoculated was 66.6 per cent., while among the vaccinated it was only 16.6 per cent. However, the number of the vaccinated exposed in this epidemic was too small to justify any positive conclusions. The size of the dose employed is one suspended twenty-four-hour agar start for adults, and from one-third to one-half this quantity in children. Strange to say, injections of these large amounts cause no severe reactions. The fact that the culture remains avirulent is determined from time to time by animal tests. Experiments on monkeys show that the avirulent pest bacilli are found quite abundantly in the tissue about the point of inoculation for from six to eight hours, after which time they gradually diminish, and after twenty-four hours they are seldom detectable. Strong holds that his method of inoculation for pest is a true vaccination, "the organism reproducing itself in the tissues for probably one hundred or more generations, and its successive groups of receptors stimulating the production of corresponding groups of amboceptors in the animal body."

In inoculating against cholera Strong injects 1 c.c. of the extract from virulent bacteria made according to the methods of Brieger and Neisser and of Shiga and Wassermann. He has treated over 6000 people by this method, and concludes that from a single inoculation a higher immunity can be obtained by this prophylactic than by any other.

PFEIFFER (*Ibid.*, 1071) discusses vaccination against typhoid fever, pest, and cholera. In the first place he speaks of the preparation of the vaccine. He states that not every culture is suitable for this purpose. In order to have a good cholera vaccine it is necessary to have a highly virulent culture. With typhoid fever the question of suitability of the culture is much more complicated, for, as Wassermann says, it is not the virulence of the culture so much as the affinity of the bacilli for the specific amboceptors that must be regarded as the determining factor; therefore the preferable culture is the one that absorbs from an immune serum the greatest amount of the anti-bodies. This can be determined

only empirically on either men or animals, and the culture that induces the most marked specific changes in the blood should be selected. It is probably better still to employ a culture of mixed strains. The vaccine of Pfeiffer and Kolle is prepared by adding the growth on agar cultures to physiological salt solution and sterilizing at  $60^{\circ}$ ; that of Wright by sterilizing young cultures at  $60^{\circ}$  (this has been changed by the commission, as has been stated, to heating for one hour at  $50^{\circ}$ ); that of Löffler by drying the cell substance at from  $120^{\circ}$  to  $150^{\circ}$ ; that of Macfayden and Rowland by rubbing up or grinding the bacilli at the temperature of liquid air; that of Neisser and Shiga, also that of Wassermann, by sterilization at  $60^{\circ}$ , and subsequent autolysis for five days at  $37.3^{\circ}$ ; when the culture is filtered through porcelain, after which the filtrate may be used directly (method of Neisser and Shiga), or it may be evaporated in vacuo and the dry residue employed (the method of Wassermann); that of Brieger, Conradi and Meyer, by suspending the living bacillus in distilled water, shaking vigorously for three days, and filtering through porcelain. Pfeiffer is inclined to the belief that the dose of the vaccine should be large enough to induce slight toxic effects. Subcutaneous injections are safer than intravenous ones, and in most instances the former are preferable, although a higher degree of immunity may be obtained with smaller doses intravenously. Two or three inoculations at intervals of from five to eight days are recommended as preferable to single ones. For typhoid fever, Löffler seeks to induce local intestinal immunity by long-continued administration of dead bacilli per os, and he has succeeded by this method experimentally in immunizing field mice to mouse typhoid. The possibility of developing a negative phase by vaccination is a question of the greatest importance. Pfeiffer is inclined, from his experimental work on animals, to deny that vaccination is followed by a negative phase, but he is cautious in his statements on this point. The work of Bail with his aggressins and that done with the typhoid residue in this country, certainly suggest the possibility of using the vaccine in too large doses; however, this would be much less likely to happen with the insoluble germ substance than with the soluble aggressins and residues. But the latter must prove to be the more suitable vaccines on account of their solubility, their ready diffusibility, and because they induce no toxic effect. It seems that even the most scientific men are slow to believe that any protective or curative agent can be of service to the body unless its administration is followed by some recognizable toxic effect.

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